## RG 104, Sequence 171

8NS-104-95-171, Miscellaneous Correspondence, working papers, reports, studies & photographs of the "U.S. Mint Site Selection," 1970 - 1979. RG 104 FY 09

### **UNITED STATES MINT**

Denver Colorado

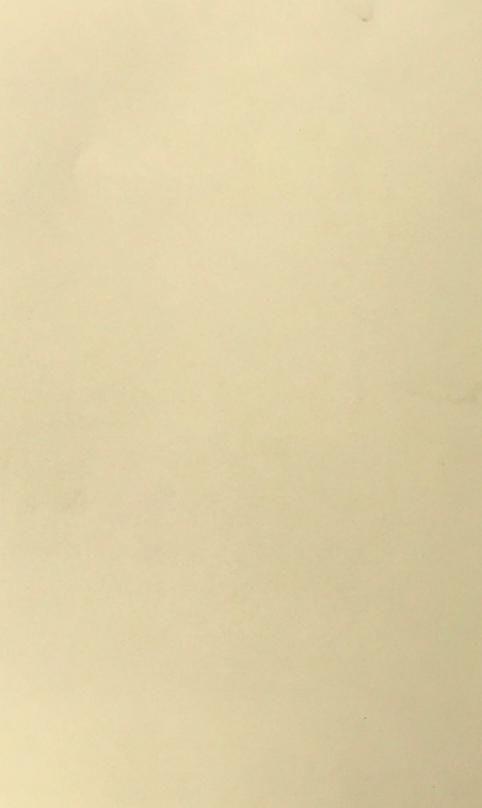
Architectural site plans for "New Denver Mint" Misc. Correspondence, Working Papers, Reports, Studies and Photographs for "US Mint Site Selection" 1970-1979

OLD FRC 104-89-0005

8NS 104-95-171

Box 1

A/E Selection



Director, Public Buildings Service Region 8 General Services Administration Denver Federal Center Denver, Colorado 80225

- 1. Attached is a proposed Scope of Architect-Engineer Services for the Design of the new Denver Mint. The Treasury Department desires that this material, with any amendments that are appropriate to comply with General Services Administration procedures, be used in requesting a proposal from the selected architect-engineer firm, and in contracting with this firm for design services. Because of our proprietary interest in all details of the new mint project, and the unique industrial processes inherent to a mint, we in the Bureau of the Mint would like to review the request for a proposal before dispatch to the A/E, and we would like to participate in all discussions and negotiations with the A/E in arriving at a design contract.
- 2. Our intent in the Bureau of the Mint is that the A/E does not need to propose amendments to the Planning Criteria and the Coin Data Tables enclosed with the proposed Scope of Architect-Engineer Services. It is assumed that the A/E would review, and perhaps propose amendments to, the Scope of Services itself and the Design and Construction Schedule enclosure during the design contract negotiation period. As the A/E proceeds with his work, it is expected that he would review and develop amendments and/or alternatives to the data and information contained in the other enclosures.
- 3. Our plan for the design and construction of the new mint is generalized in Enclosure 1 to the proposed Scope of A/E Services. As this enclosure shows, we visualize that the A/E would concentrate his

and layout. After approval by the Bureau of the Mint of this system and layout, the A/E would prepare detailed procurement documents for the process equipment items. These are such items as the Melting and Casting Equipment, the Preheat Furnace, the Ingot Hot Roll Mill, the Scarfing Mill, the Intermediate and Finishing Mills, and others. The Bureau of the Mint would use these documents in procuring the production process equipment. The procurements would include all direct supporting equipment (particularly electrical and mechanical), spares and advisory services by the manufacturer during the installation phase. These procurements would be in two major phases, as shown, due to variances in procurement lead times.

4. As the Design and Construction Schedule depicts, it is our intent at this time that only one contract will be awarded for construction/installation on the site. We believe that this is a feasible and proper approach, as this project is not on a critical or "crash" time basis. We have the time, and want to take the time, to assure that the new Mint is designed, constructed and equipped to provide a quality facility. Quality and efficiency are more important than completion time. With only one construction contract, we will avoid the inherent problems of phased construction and multiple contracts, wherein the efforts of different contractors have to be integrated with respect to time and space. On special cases, this approach may be modified. For instance, we might have a separate contract for site preparation (demolition, relocation of utilities and sewers, site grading, etc.). Also, we may elect to have equipment manufacturers install process

equipment, particularly in the case of a few of the major critical items, such as the Melting and Casting equipment and the Ingot Hot Roll Mill. Decision on the number of contracts should be deferred until we have progressed with the design. For now, the Bureau of the Mint decision is to proceed on the basis of one major construction contract. The major process equipment would be provided as Government-furnished equipment for the contractor to install. All normal building equipment would be procured and installed by the construction contractor.

- 5. Based on the concepts and procedures discussed above, following are our ideas relative to the use of a construction manager on this project:
- a. In general, we favor the use of a construction manager. We feel, however, that the preponderance of the construction manager's activities should be with respect to services during the construction/installation phase of the project. We agree that some tasks, such as review of plans and specifications, and other activities which would serve to prepare the construction manager for his construction phase work, are appropriate functions for the construction manager during the design phase. On the other hand, we do not want to pay a construction manager for services which we in the Bureau of the Mint can and should perform with in-house staff.
- b. The construction manager must be selected carefully on the basis of proven performance on projects of similar magnitude and complexity. The selected construction manager must have successful experience on large manufacturing facilities, specifically metal

processing plants, with the Bureau of the Mint having final approval authority on the construction manager selection.

c. The following, keyed to the standard form GSA Construction Management Contract, are our comments on the specific functions to be performed by the construction manager:

### SERVICES DURING DESIGN PHASE

- (1) Paragraph 4a Plans and Specifications Recommendations

  We are desirous that all plans and specifications pre
  pared by the A/E be reviewed as they are developed, including a

  thorough, complete review prior to issuance of Invitation For Bids.

  We agree that this is an appropriate construction manager function,

  along with the other items detailed in this paragraph.
  - We believe that it is more appropriate for the A/E to develop a budget estimate at the concept stage and comprehensive quantity and cost estimates when the working drawings are 50 percent complete and 100 percent complete. In general, we feel that the A/E's responsibility for producing an excellent economical design should not be dilluted, thus the prime action with respect to cost control should be on the part of the A/E. In this regard, we want the A/E to produce a design which reflects the importance and dignity of the minting function, and which provides an efficient, economical facility, with quality and excellence of design more important than designing to a fixed facility cost.

### (3) Paragraph 4c - Long Delivery Procurement

We would expect the A/E, rather than the construction manager, to make recommendations on long lead time procurements, as

it is expected that nearly all of such procurements would involve production process items. Review of A/E recommendations and decisions on procurement actions would be accomplished by the Bureau of the Mint in conjunction with GSA.

- (4) Paragraph 4d Separate Construction Contract Documents

  The review of plans and specifications with the architect-engineer regarding the division of work and decisions on awarding separate construction contracts to permit phasing of design development and project construction can be performed readily by me and my staff. We would not object to a minor input from the construction manager on this function, but we would not want this aspect of the construction manager's responsibilities to have any significant emphasis. As we foresee little need for phased construction, this matter is not too relevant.
- (5) Paragraph 4e Interfacing Separate Construction Contracts

  This would be an appropriate task for the construction

  manager, but the work involved is expected to be minor due to the

  absence of multiple contracts.
  - (6) Paragraph 4f Job Site Facilities

The functions discussed in this paragraph are appropriate for accomplishment by the construction manager.

### (7) Paragraph 4g - Bid Documents and Date

The items discussed are appropriate construction manager tasks, but here again, the work involved would be minimal because of the one major contract concept.

(8) Paragraph 4h - Prebid Construction Network Analysis

This is considered to be an appropriate construction
manager task.

### (9) Paragraph 5 - SERVICES DURING CONSTRUCTION

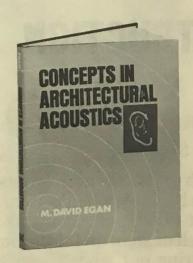
All the functions listed in this paragraph are appropriate items for performance by the construction manager, subject to the following comments:

- (a) As noted before, Bureau of the Mint procurement contracts for production process equipment will include provisions for advisory technical services to be furnished on the site by the manufacturers during the equipment installation period. In effect, these manufacturer's technical representatives would serve as part of the Government supervisory and inspection staff for each major process item, thus the construction manager's activities, and his fee, would be reduced thereby.
- (b) Factory inspections of process equipment procured by the Bureau of the Mint will be arranged for separately by the Bureau.
- 6. I trust that the foregoing meets with your approval and is in accordance with General Services Administration policies and procedures.

  I will be happy to discuss these matters with you at your convenience.

Frank W. Rhea Facilities Project Manager Bureau of the Mint Denver, Colorado

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## **About the Author**

M. DAVID EGAN heads his own consulting firm in South Carolina and is an associate professor in the College of Architecture at Clemson University. He holds a B.S. degree from Lafayette College and an M.S. degree from the Massachusetts Institute of Technology. After graduation he worked for the Shell Oil Company and in 1968 joined the consulting staff of Bolt, Beranek, and Newman, Inc. where he worked on the design and engineering of a wide range of projects in architectural acoustics and noise control. Prof. Egan is a member of the Acoustical Society of America and other professional organizations.

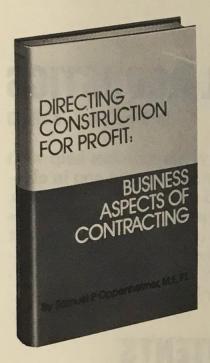
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Samuel P. Oppenheimer. M.E., Stevens Institute of Technology, and P.E., New York and New Jersey, has had a long and varied career in construction. He was a survevor on the Holland Tunnel. office supervisor on a skyscraper, construction supervisor on a multi-family garden apartment complex, subcontractor on structural-steel erection (the basis of his Mc-Graw-Hill book, "Erecting Structural Steel"). He is an authority on estimating, pricing, buying, and selling contracting, negotiating, supervising, expediting, handling insurance and safety programs, distributing payroll, and many other important functions.

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## **The Authors**

Both authors are well known to practicing engineers for their frequent contributions to technical publications and for their extensive consulting activities in the U.S. and Canada.

RONALD F. SCOTT, Professor of Civil Engineering, California-Institute of Technology was Principal Investigator of the NASA Surveyor Spacecraft Lunar Soil Mechanics Experiments and Soil Engineering Consultant to the Apollo program. He serves as soil engineering consultant to a number of organizations, including FUGRO, U.S., Inc. and the Atomic Energy Commission.

JACK J. SCHOUSTRA, President of FUGRO, U.S., affiliate of N.V. FUGRO, Netherlands, Consulting Engineers and Geologists has been a Geotechnical Consultant in the U.S. and Canada for 15 years.

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Soil Drainage and Dewatering — restraint of flow; drainage through gravity flow; dewatering with forced flow; secondary effects of dewatering.

Soil Property Modification and Pavement Design – soil compaction; hydraulic fills; soil stabilization with additives; pavement design.

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Legal Counsel to the New York Chapter of the AIA

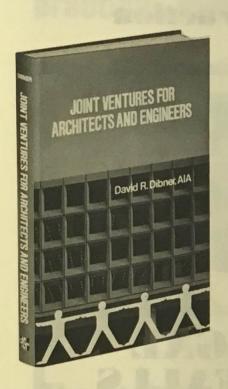
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### ABOUT THE AUTHOR:

DAVID R. DIBNER is a partner in the Grad Partnership, Architects, Engineers, and Planners of Newark, N.J., and studied at Brooklyn College in New York before receiving his Bachelor of Architecture degree in 1949 from the University of Pennsylvania. Throughout his years of practice, he has conceived, developed, and directed many joint ventures, including the \$36 million James Forrestal Building in Washington, D.C. He has written numerous articles on architecture for national magazines and has contributed, as speaker and discussion leader, to management seminars. He is also an Adjunct Professor at Seton Hall University.

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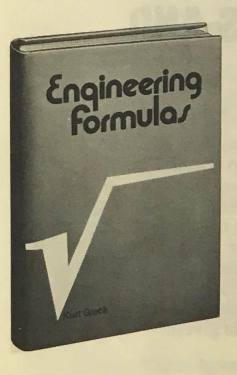
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ASGOLDMANICHO DENVER A. M. KINNEY, INC. CONSULTING ENGINEERS 2912 VERNON PLACE CINCINNATI, OHIO NEW YORK 513-751-3934 45219 CHICAGO DENVER CABLE - KINPLAN June 19, 1972 Mr. George G. Ambrose Bureau of the Mint Department of the Treasury Room 204 1331 G Street, N.W. Washington, D. C. Dear Sir: In accordance with our policy of providing up-to-date information for your files, we are submitting the latest information on our firm's present capabilities and past experience as requested in the enclosed Standard Form 251. We are also including a list of our experience in the field of environmental control. We would be most pleased to meet with you to discuss our services for any future projects you may consider or to provide any supplementary data you may desire. Very truly yours, A. M. KINNEY, INC. President Enclosures

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### TYPICAL PROJECTS

#### SEWAGE AND INDUSTRIAL WASTE TREATMENT

### AIR POLLUTION CONTROL, AND SOLID WASTE RECYCLING

#### CLIENT

U. S. Department of the Interior, Federal Water Pollution Control Administration

Air Pollution Control
Office - Environmental
Protection Agency

#### TYPE OF PROJECT AND LOCATION

Experimental industrial and sanitary waste treatment pilot plant with activated sludge and trickling filter features
Cincinnati, Ohio

The following task orders are completed or in progress:

Evaluate processes and prepare capital operating cost estimate for Mitsubishi SO<sub>2</sub> process

Review of process design and preparation of cost estimate for molten salt process for SO<sub>2</sub> removal from stack gas

Review of process design and cost estimate for plant for solvent processing of coal to produce ash-free coal

Evaluation of British version of alkalized alumina process for (1) effect on Claus operation (2) applicability of fluidized bed for absorber

Assessment of fluid bed reactor and Claus sulfur recovery for application to alkalized alumina process

Preparation of preliminary construction cost estimate for SO<sub>2</sub> removal plant using alkalized alumina

Estimate of budgetary cost for sulfuric acid plant utilizing enriched air for fluidized bed roaster for pyrites

#### ESTIMATED COST

100,000

### TYPE OF PROJECT AND LOCATION

Air Pollution Control Office - Environmental Protection Agency Determination of costs to produce various reducing gases for alkalized alumina process

Technical and economical evaluation of fluid bed combustion application to industrial steam and power plant boilers

Order of magnitude cost estimate for dolomite-SO<sub>2</sub> removal test unit, Detroit Edison unit

Review and evaluate line scrubbing SO<sub>2</sub> removal plant design - TVA Shawnee plant

Preparation of report for air pollution problems relative to secondary aluminum industry emissions

Feasibility investigation to determine effect of deep cleaned coal on utility economics

Survey of industry to identify sources of significant air pollution and computerization of procedure for data handling

Evaluation of 24-hour performance guarantee for the Cat-ox installation at Illinois Power Company's Wood River plant

Review of solvent refined coal process economics

Preparation of report covering  $NO_X$ ,  $SO_X$ , and particulate emission for submission to OECD by EPA, and subsequent updating

Development of petroleum refinery background information for the establishment of federal standards of performance for stationary sources

Develop rendering plant background information for the establishment of federal standards of performance for stationary sources

### TYPE OF PROJECT AND LOCATION

Air Pollution Control Office - Environmental Protection Agency Develop information for air pollution control standards for the petrochemical industry (carbon black, derivatives of benzene and xylene)

Develop information for air pollution control standards for the petrochemical industry (ethylene and its derivatives)

Information collection and compilation for input to comprehensive  $SO_{\mathbf{X}}$  control process file and coal gasification and liquefaction process files

Assessment of increased electrical energy requirements resulting from implementation of air pollution laws

Neutralization of abatement derived sulfuric acid

Evaluation of sulfur dioxide from natural gas fields

Evaluation of fuel treatment and fuel conversion processes

Study of  $\mathrm{NO}_{\mathbf{X}}$  control technology for nitration processes

Study of control technology for chlorination processes

Study of air pollution from Claus plants, report findings, and propose plan for industry contacts

Investigation of feasibility and develop design basis for prototype plant for limestone neutralization of sulfuric acid from air pollution control facilities

Justification of research and development program for particulate control in air pollution

Evaluation of combustion sources for  ${\rm NO}_{\rm X}$  emissions

CLIENT	TYPE OF PROJECT AND LOCATION	ESTIMATED COST
City of Alexandria	600,000 gpd sewerage system, and pumping stations Alexandria, Kentucky	\$ 1,000,000
American Hoechst Corp.	Design of carbon adsorption solvent recovery system Bridgewater Township, New Jersey	
Amoco Chemicals Corp.	Waste treatment facilities for industrial waste with high dissolved BOD content. Project involved aeration lagoons, clarification basins, and sludge drying beds Decatur, Alabama	900,000
Black-Clawson Company	Development of process for disposal of refuse Middletown, Ohio	
Burgess & Niple, Limited	Area consultant on preparation of a water resources development plan - four southwest counties in Ohio. Included waste treatment facilities projected to the year 2020	
The Philip Carey Manu- facturing Company	Modification of industrial waste system for paper and asphalt roofing plant Perth Amboy, New Jersey	350,000
Ciba-Geigy Corporation	Major herbicide dust control system concept St. Gabriel, Louisiana	
Columbus Coated Fabrics Division, Borden Company	Design of mechanical collector system for boiler application to reduce ash in stack gas Columbus, Ohio	
Davison Chemical Division, W. R. Grace & Co.	Fine silica dust control system Cincinnati, Ohio	
A. B. Dick Company	Carbon adsorption unit for mixed organic solvents for coated products plant Niles, Illinois	
DuBois Chemicals Division, W. R. Grace & Co.	Chemical plant dust collection system Cincinnati, Ohio	
FMC Corporation (Inorganic Chemicals Division)	Sedimentary waste retention basin Charleston, West Virginia	75,000

CLIENT	TYPE OF PROJECT AND LOCATION	ESTIN	MATED COST
FMC Corporation	Collection, neutralization, and activated sludge treatment for wastes from organic chemical plant Nitro, West Virginia	\$	200,000
City of Fairborn, Ohio	2,000,000 gpd sanitary sewage treatment plant Fairborn, Ohio		800,000
Farmers Chemical Company	Ammonia-nitric acid fertilizer plant, de- ionizer concentrate evaporation and recycle system Ahoskie, North Carolina		
Formica Corp., Subsidiary American Cyanamid Company	Study for waste heat boiler burning process waste Cincinnati, Ohio		
City of Franklin	Solid waste disposal system using Hydra- pulper and fluid bed reactor Franklin, Ohio		1,000,000
General Electric Company	Plating wastes treatment facility Cincinnati, Ohio		50,000
General Motors Corporation	Consultation on scrap metal recovery process Warren, Michigan		
Harris Intertype Corporation	Analysis and report on waste disposal problems 18 corporation plants		
Hoover Ball & Bearing Co.	Preliminary studies for design of scrap steel recovery plant Saline, Michigan		
ICI America, Inc.	Pneumatic handling & dust collection system for TNT Chattanooga, Tennessee		6,000,000
Illinois Tool Works, Inc.	Plastics dust collection and control system Chicago, Illinois		
International Business Machines Corporation	Carbon adsorption for recovery of organic solvents from fume exhaust system Lexington, Kentucky		
Leadville Corporation	Design of nonpolluting nonferrous ore pro- cessing system Leadville, Colorado		

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### TYPE OF PROJECT AND LOCATION

ESTIMATED COST

Eli Lilly and Company

Waste neutralization for power plant dealkalizer and deionizer regeneration effluent Greenfield, Indiana

Design of a treatment system for industrial waste from a chemical manufacturing and fermentation facility. Project involved two incinerator systems for organic and inorganic waste, dehydration and incineration for high BOD watery waste, a multichambered trash and rubbish incinerator, special evaporation and stripping columns in solvent recovery areas, and a sanitary waste treatment plant Clinton, Indiana

Expansion of biological treatment system for fermentation wastes Lafayette, Indiana

Mars, Inc.

Sugar dust control system Hackettstown, New Jersey

Mead Corporation

Study and design of pulp and paper waste treatment and recycle system Chillicothe, Ohio

Mead Johnson and Company Div., Bristol-Myers Company Biological waste treatment facility Evansville, Indiana

Mobay Chemical Company

100 ton per day hydrochloric acid adsorption and scrubbing system New Martinsville, West Virginia

Monsanto Company

Processing system and incinerator for toxic vapors, liquids and solids Anniston, Alabama

National Power Rodding Corp.

Thermal oxidation process installation for wide range of solvents Franklin, Ohio

Nepera Chemical Co., Inc. Div., Warner-Lambert Pharmaceutical Company Plant-wide pyridine vent gas collection and incineration system Harriman, New York \$ 10,000,000

CLIENT	TYPE OF PROJECT AND LOCATION	ESTIMATED COST
City of Norwood, Ohio	150 ton per day incinerator Norwood, Ohio	\$ 700,000
Novamont Corporation	Activated sludge sewage treatment plant Neal, West Virginia	
	Process waste treatment for oil recovery and settleable solids from plastics manu- facturing plant Neal, West Virginia	
Ohio State Department of Natural Resources	Complete sanitary treatment plant Cowan Lake State Park, Ohio	60,000
Olin Mathieson Chemical Corporation	Solvent recovery and fractionation system Brandenburg, Kentucky	200,000
Owens Corning Fiberglas Co.	High temperature furnace fume control process study Toledo, Ohio	
Parke, Davis and Company	Hydrogen cyanide scrubbing system Holland, Michigan	
Pennwalt Chemicals Corp.	Design of low temperature compression and condensation system for removal of chlorine tail gas from vent stream Calvert City, Kentucky	
The Procter & Gamble Company	Black liquor recovery unit, including high pressure steam generation and electrical generation Foley, Florida	8,000,000
	Waste recovery unit for burning paper mill sulphite waste in conjunction with bark, coal, gas, and oil Green Gay, Wisconsin	4,000,000
	Dust control system for detergent plant Alexandria, Louisiana	
	Dust control system for detergent plant Lima, Ohio	
	Dust control system for detergent plant Augusta, Georgia	
	System for reduction of particulate matter and visual plume emission from synthetic detergent plant St. Bernard, Ohio	

CLIENT	TYPE OF PROJECT AND LOCATION	ESTIMATED COST
The Procter & Gamble Company (continued)	Precipitator system for reduction of particulate matter in emission from boiler plant Ivorydale, Cincinnati, Ohio  Addition of dust collection system for No. 6 oil burning boiler with facilities for future electrostatic precipitator Baltimore, Maryland	
Purdue University	Design of mechanical collector and electrostatic precipitator system for ash elimination in boiler stack gas Lafayette, Indiana	\$ 125,000
Queen City Barrel Company	Study for reclamation of organic waste from air in barrel cleaning operation Cincinnati, Ohio	
Republic Steel Corporation	Nitric and hydrofluoric acid pickle liquor recovery and disposal system Massillon, Ohio	
Rock Island Refining Company	Alkylation feed preparation sulfur removal plant Indianapolis, Indiana	500,000
City of St. Marys, Ohio	2,000,000 gpd sewage treatment plant St. Marys, Ohio	500,000
Sherwin-Williams Company	Preliminary design for collection and treatment of industrial waste from chemical manufacturing plant Ashtabula, Ohio	175,000
The Standard Oil Company (Ohio)	Hydrogen cyanide tail gas compression and liquefaction facility Lima, Ohio	500,000
Stauffer Chemical Company	Process study for multiproduct organic chemical plant including phenols and cresols Trenton, New Jersey	
Tennessee Eastman Company	Two solvent recovery systems from mis- cible and immiscible solvents Kingsport, Tennessee	

CLIENT	TYPE OF PROJECT AND LOCATION	ESTIMATED COST
Thompson Hayward Chemical Company	Study and design for treatment of pesticide and herbicide wastes Kansas City, Missouri	
Tri State Improvement Company	Industrial and sanitary waste treatment study for 3,000-acre industrial complex Middletown, Ohio	\$ 7,500,000
Union Carbide Corporation	Chemical waste sludge, and fly ash collection system and a retention basin Institute, West Virginia	2,000,000
U. S. Army Corps of Engineers, Omaha District Joliet, Illinois	Waste treatment facility for sulfuric acid regeneration unit, direct strong nitric acid unit, and an ammonia oxidation unit	2,500,000
	Carbon adsorption system for removal of nitrobodies	500,000
U. S. Army Corps of Engineers, Baltimore District Radford, Virginia	Technical evaluation of air and water pollution control program for ammunition plant including:	
natora, virginia	Air pollution abatement for acid tanks	418,000
	Nitrocellulose fines separation	7,000,000
	TNT plant waste water treatment	2,000,000
	TNT plant air pollution abatement	2,000,000
	Waste acid water pollution abatement	9,000,000
U. S. Atomic Energy Commission	Bindery trimmings disposal system Oak Ridge, Tennessee	25,000
	Uranium metal, salts, and acid processing and disposal system Fernald, Ohio	150,000
	Sanitary sewer collection system includ- ing lift station and force main Portsmouth, Ohio	4,000,000
Universal Wire Company	Chemical waste treatment plant Clinton, Connecticut	175,000

CLIENT	TYPE OF PROJECT AND LOCATION	ESTIN	MATED COST
Wadsworth Electric Company	Waste treatment system for treatment of waste from a painting and a plating system Kenton County, Kentucky	\$	25,000
Wean United Corporation, Conservall Co. Div.	Steel mill pickle liquor acid recovery process installation		

Warren, Ohio

### ARCHITECT-ENGINEER EXPERIENCE DATA

Presented herein is a resume of the aggregate personnel, experience, and capabilities of the Architect-Engineer firm of A. M. Kinney, Inc., and its affiliates, A. M. Kinney Associates, William J. Rabon; A. M. Kinney Associates, Inc.; Processes Research, Inc.; Techlab, Inc.; and Kintech Services, Inc., to which it bears the following relationships:

- A. M. Kinney Associates, William J. Rabon, 2900 Vernon Place, Cincinnati, Ohio 45219, is a partner-ship which engages primarily in architectural work. Partners holding a majority interest in the partnership are also stockholders, directors, and officers of A. M. Kinney, Inc.
- 2. A. M. Kinney Associates, Inc., 4747 Dempster Street, Skokie, Illinois 60076, is a corporation organized in Illinois, that renders architectural and engineering services. The controlling interest in this firm is held by A. M. Kinney, Inc., and Processes Research, Inc.
- Processes Research, Inc., 2900 Vernon Place, Cincinnati, Ohio 45219. The controlling interest in Processes Research, Inc. is held by the same persons who own the controlling interest in A. M. Kinney, Inc.

The major part of the work performed by Processes Research, Inc., consists of the development of chemical process design, machine design, automation, instrumentation and materials handling systems, and industrial production equipment, methods, arrangements, and systems, and the planning, layout, and functional development of building projects. Processes Research, Inc. also engages, however, in the planning and development of industrial processes.

4. Techlab, Inc., 11635 Deerfield Road, Cincinnati, Ohio 45242. The controlling interest in this firm is held by A. M. Kinney, Inc., and Processes Research, Inc.

The services rendered by Techlab, Inc. includes preparation and supervision of subsurface exploration programs, the conduct of related and analytical tests, and classification of soils. Its laboratory is equipped and staffed to provide the basic data necessary to foundation design for all types of structures, the control of compacted fills, and the limitation and equalization of settlement in heavy structures.

5. Kintech Services, Inc., 2900 Vernon Place, Cincinnati, Ohio 45219. The controlling interest in Kintech Services, Inc. is held by the same persons who own the controlling interest in Processes Research, Inc.

Kintech Services, Inc. engages in the performance of consulting services parallelling those of Processes Research, Inc.

Attention is respectfully invited to the following supplementary information:

1. Length of time established in business:

A W W.	THE RESERVE OF STREET STREET	
A. M. Kinney, Inc.	(Established 1929)	43 years
A. M. Kinney Associates, William J. Rabon		
A W W.	(Established 1945)	2/ years
A. M. Kinney Associates, Inc.	(Established 1959)	13 years
Processes Research, Inc.	(Established 1945)	
Techlab, Inc.	(Established 1958)	14 years
Kintech Services, Inc.	(Established 1968)	4 years

2. Total employees at present:

A. M. Kinney, Inc.	225
A. M. Kinney Associates, William J. Rabon	21
A. M. Kinney Associates, Inc.	27
Processes Research, Inc.	61
Total	334

3. All of the above organizations are engaged in closely allied fields of work. The skill and experience of their staffs are such that their forces may be readily combined and coordinated on any project.

4. The total aggregate floor space occupied by A. M. Kinney, Inc. and its affiliates is as follows:

Cincinnati, Ohio

New York Office

Chicago Office

Denver Office

119,500 square feet
1,473 square feet
6,300 square feet
3,704 square feet

Total 130,977 square feet

- 5. It has been the established policy of A. M. Kinney, Inc., and each of its affiliates, to employ, insofar as practicable, only thoroughly qualified and experienced professional engineers and architects, and to use a minimum of ordinary draftsmen. The effectiveness of this policy in producing work of a higher quality, in less time, with fewer mistakes, and at a lower overall end cost than with the more conventional organizational set-up, which uses a larger proportion of draftsmen, has been proved. At the same time, it enables each firm to expand its forces very rapidly and to undertake and efficiently perform large volumes of work without undue stress in management and design staffs.
- 6. Our firm is in a position to undertake additional work of a considerable magnitude, and has always proven capable of completing Government contract work within the prescribed time limits. We refer you to the U. S. Army, Corps of Engineers, Louisville, Huntington, and Pittsburgh Districts, for confirmation of this statement.
- 7. A. M. Kinney, Inc., and its affiliates currently employ 262 technically trained personnel, of which 21 are registered architects and 104 are registered engineers.

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. CIVIL	ENGINEERS  LOCATED AT  OFFICE  New York	a. PRINCIF ARCH. (1) 11	PALS & SEY ENG. (2) 71 1 6 4	NUMBE PERSONNEL*  OTHER (3) 4	ARCH.	RSONNEL  (5)MECH.  21	ERS (Ind.  IN YO ENGI  (6) ELEC. 17	icate Special IUR PRES NEERS (7)CIVIL 24	SENT OR b. ot  (8) OTHER	GANIZA HER PERSU DRAFTS-MEN (9) 29	TION MANEL SPEC. WRITERS (10) 3	ESTIMA- TORS	NHEL (Inc.  IHSPECTORS (12)  9	survey-	BALANCE (14) 61 3 3	Total: (15) 285 2 - 20 - 27
LANDS	ENGINEERS  LOCATED AT  OFFICE  New York  Denver	a. PRINCIP ARCH. (1) 11	PALS & KEY ENG. (2) 71 1 6	NUMBE PERSONNEL*  OTHER (3)	ARCH.	RSONNEL  (5)MECH.  21	ERS (Ind. IN YO ENGI (6) ELEC. 17	icate Special IUR PRES NEERS (7)CIVIL 24	SENT OR	GANIZA HER PERSO DRAFTS- MEN (9) 29	TION SPEC. WRITERS (10)	ESTIMA- TORS (11) 1	NHEL (Inc.  IHSPECTORS (12)  9	survey-	BALANCE (14) 61 1 3 68	Total: (15) 285 2 - 20

12.	(Furnish a separat	SIDE ASSOCIATES AND CONSULTA	NTS USUALLY	EMPLOYED BY YOUR FIRM idual listed below but see note c, page 9)
a. CATEGORY		OR INDIVIDUAL AND ADDRESS	a. CATEGORY	
١.	25.602	THE INTERIOR CONTROL	F.	b. NAME OF FIRM OR INDIVIDUAL AND ADDRESS
ARCHITECTS	NONE		MECHANICAL ENGINEERS	NONE
В.	Lity of Cincinnati		G.	TO THE SHARE THE
LANDSCAPE ARCHITECTS	NONE		ELECTRICAL ENGINEERS	NONE
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CIVIL ENGINEERS	NONE		PLANNERS	NONE
D.	TOTAL SHEET WILLIAM		1.	
STRUCTURAL ENGINEERS	NONE		ESTIMATORS	NONE
SANITARY ENGINEERS	NONE	ent too)	J. OTHER CONSULTANT AFFILIATIONS	Ayers & Graf, Civil Engineers & Surveyors 527 Linton Street, Cincinnati, Ohio; H. C. Nutting Company, Testing Engineers 4120 Airport Road, Cincinnati, Ohio
3 ACOUS	STICS - SOUND SUPPRESSION	2 HOSPITALS 3 HOUSING 1 INDUSTRIAL BUILDINGS	1 PUBLIC BU	UILDINGS  AND REPORTS  Discourse And Reports  BY SPECIALIZES (Work specialties not sufficiently identified sufficiently
BRIDO		I IRRIGATION OR DRAINAGE	1 WATER - SI	SEWAGE 1 Air Pollution Control
		LABORATORIES		
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1 CHEM	IICAL FACILITIES	1 MANUALS	1 Recrea	tion Facilities 1 Water Pollution Control
1 CHEM	UNICAL FACILITIES	1 MANUALS  MASTER PLANNING - SITE DEVELOP.	Palamont	
1 CHEM	IICAL FACILITIES	1 MANUALS	Palamont	tion Facilities 1 Water Pollution Control Control Studies
1 CHEMI	INICAL FACILITIES  JUNICATIONS  JERCIAL BUILDINGS	1 MANUALS 1 MASTER PLANNING - SITE DEVELOP. 1 MILITARY STANDARD DESIGN	1 Flood (	- 5 1001 St S
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All of the services listed in Item 13 above are provided by our firm without the use of outside associates.

	IPALS AND ASSOCIATES WITHIN YOUR FIRM a but keep to essentials)
NAME (Last-first-middle initial) Kinney, Aldon M., Jr.	D. NAME (Last-first-middle initial) Morris, John R.
May 19, 1921  YEARS OF EXPERIENCE  AS PRINCIPAL AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL  OF EXPERIENCE  18  5	July 24, 1909  AS PRINCIPAL AS PRINCIPAL OTHER THAN IN THIS FIRM IN OTHER FIRMS PRINCIPAL OTHER THAN PRINCIPAL 10
University of Cincinnati Master of Laws	EDUCATION (College, degree, year, specialization)  Ohio State University  B.S.C.E.
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS AMERIcan Bar Association Cincinnati Bar Association	MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS AMMERICAN Society of Civil Engineers, American Concrete Institute.  Civil: W.Va. Ohio'45:Fla.,Cal.'53; Pa.,Iowa'55; S.D.,Ill.,Tenn.,Ind.,Mo.,NY,Ky.,Mich.,'60; Ga.'61;Ariz.'63;Va.
REGISTRATION (Type, year, State) Ohio	NJ, La. '66; S.C., Mass. '67
B. NAME (Last-first-middle initial) Ahlbrand, R. L.	E. NAME (Last-first-middle initial)  Kîrwîn, Lawrence P.
March 29, 1924  March 29, 1924	January 19, 1910  January 19, 1910  Sexperience 26  AS PRINCIPAL AS PRINCIPAL IN THIS FIRM OTHER FIRMS PRINCIPAL OF EXPERIENCE 26
EDUCATION (College, degree, year, specialization)  University of Cincinnati B.S.E.E.	EDUCATION (College, degree, year, specialization)  West Virginia University  B.S.E.E.
American Institute of Electrical Engineers, SAME, Cincinnati Engineering Society  REGISTRATION (Type, year, State) Ohio 1953, New York 1967, Maryland 1969	MFMRFRSH&P IN PROFESSIONAL ORGANIZATIONS  American Institute of Electrical Engineers,  Associate Member  REGISTRATION (Type, year, State)  Ohio 1947
C. NAME (Last-first-middle initial) Mathewson, Marvin E.	F. NAME (Last-first-middle initial) Thomsen, Carl L.
June 15, 1906  As PRINCIPAL AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL 38  38  38	February 2, 1921  VEARS  OF EXPERIENCE  AS PRINCIPAL AS PRINCIPAL IN OTHER FIRMS PRINCIPAL  OF EXPERIENCE  24
University of Cincinnati B.S.M.E.	University of Cincinnati B.S.C.E.
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS ASHRAE, Ohio Society of Professional Engineers, ASTM, Engineering Society of Cincinnati	MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS American Society of Civil Engineers
Mech.: Ohio 1935, New Jersey 1935, New York 1964	REGISTRATION (Type, year, State) Civil: Ohio 1953, Colorado 1969
251	

NAME (Last-first-middle initial) Blotter, R. D.	J. NAME (Last-first-middle initial) Roomann , Hugo
February 10, 1929 EXPERIENCE 13 AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL 7	DATE OF BIRTH (Month-day-year)  YEARS  OF  March 25, 1923  EXPERIENCE 6  AS PRINCIPAL AS PRINCIPAL IN OTHER FIRMS PRINCIPAL  OF  EXPERIENCE 6
Utah State University - B.S.C.E.  Rensselaer Polytechnic Institute - M.C.E.  Civil Engineering, Soils Mechanics, & Foundation Engrg  MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS  American Society of Civil Engineers	EDUCATION (College, degree, year, specialization)  Institute of Technology, West Germany Princeton University, M.F.A., Architecture Princeton University Graduate School, Architecture MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS American Institute of Architects
REGISTRATION (Type, year, State) Ind. '61, Ill. '62, Ohio '59, Ky. '70, Mich. '72  H. NAME (Last-first-middle initial) Friedman, Jerome S.	REGISTRATION (Type, year, State) NJ 59;NY 64;NCARB 65;Unio,Conn, Mich, Pa, Ark, Ind, Wisc, Ky 66; Mass, Tenn, Va, W. Va, La 67;RI, Ga 68; Cal 69,Col 70  K. NAME (Last-first-middle initial) Lund Lamon H
November 6, 1918   YEARS OF EXPERIENCE   S PRINCIPAL IN THIS FIRM IN OTHER FIRMS PRINCIPAL   AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL   AS PRINCIPAL	Lund, James H.  DATE OF BIRTH (Month-day-year)  August 1, 1931  EXPERIENCE 3  AS PRINCIPAL AS PRINCIPAL IN THIS FIRM IN OTHER FIRMS PRINCIPAL  EXPERIENCE 3
EDUCATION (College, degree, year, specialization)  Cooper Union Institute of Technology B.S.Ch.E  MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS	University of Pennsylvania  B. Architecture
None	American Institute of Architects
REGISTRATION (Type, year, State) None	REGISTRATION (Type, year, State) Ohio 1969
NAME (Last-first-middle initial) Rabon, William J.	L. NAME (Lest-first-middle initial) Miller, Donald R.
February 7, 1931 EXPERIENCE 4 10	April 18, 1927
EDUCATION (College, degree, year, specialization) Clemson College - Architecture - B.S. North Carolina State - Architecture - B.A. Massachusetts Institute of Technology - Arch Masters University of Rome-Post Grad. Study, City Planning & Arch.	University of Cincinnati B.S.Ch.E.
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS American Institute of Architecture: Corporate Member	MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS  American Institute of Chemical Engineers Engineering Society of Cincinnati
REGISTRATION (Type, year, State) North Carolina '60, California '63, Ohio, Maryland, '69	REGISTRATION (Type, year, State) Ohio 1956

PALS AND ASSOCIATES WITHIN YOUR FIRM but keep to essentials)					
F. NAME (Last-first-middle initial)					
Knight, H. F., Jr.					
DATE OF BIRTH (Month-day-year) YEARS IN THIS FIRM IN OTHER FIRMS PRINCIPAL					
OF 24					
September 5, 1924					
EDUCATION (College, degree, year, specialization)					
- 4 1 13 2 2 4m					
Princeton University					
B.S.M.E.					
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS					
Society of Professional Engineers, National Registratio					
None					
REGISTRATION (Type, year, State)					
Massachusetts 1960					
Q. NAME (Last-first-middle initial)					
Schnebel, Vernon H.					
DATE OF BIRTH (Month-day-year) YEARS AS PRINCIPAL IN THIS FIRM IN OTHER FIRMS PRINCIPAL					
May 6, 1912 EXPERIENCE 7 26					
EDUCATION (College, degree, year, specialization)					
University of Pittsburgh					
B.S.Ch.E.					
THE REAL PROPERTY OF THE PROPE					
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS					
American Institute of Chemical Engineers					
Garage State					
REGISERATION (Type, year, State)					
N. NAME (Last-first-middle initial)					
Yuan, John H. K.					
AS PRINCIPAL AS PRINCIPAL OTHER THAN					
OF					
June 10, 1926 EXPERIENCE 8 8					
EDUCATION (College, degree, year, specialization)					
CONTRACTOR OF THE PROPERTY OF					
St. Johns University, Shanghai, China B.S.C.E.					
University of Illinois, M.S. and Ph.D., Civil Engrg.					
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS					
Section 14 Control of					
ASCE, ACI, PCI, AISC					
4000					
REGISTRATION (Type, year, State) NJ '60; Cal., Fla., Ill., Ind., Mich., NY, Ohio & Va. '65					

NAME (Last-first-middle initial)	V. NAME (Last-first-middle initial)					
Friedman, Hans A.	Wier, Robert C.					
ATE OF BIRTH (Month-day-year) AS PRINCIPAL AS PRINCIPAL THAN						
June 10, 1921 EXPERIENCE 11 11	September 11, 1928 EXPERIENCE 12					
DUCATION (College, degree, year, specialization)	EDUCATION (College, degree, year, specialization)					
Illinois Institute of Technology B.S Architecture	Purdue University - B.S.M.E. Vincennes University - Associate - Science					
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS						
American Institute of Architects	MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS ASME, ASHRAE, National Society of Professional Engineers, National Registration Council of Engineering Examiners					
Selster on (Type Rear State) III 52; Mich 54; Ind lowa, NCARB (ass 66; Fla 67; Minn., Ky., Ga. 78; Miss, Va, Mo 64; W. Va., Pa						
Omarzu, Joseph H.	W. NAME (Last-first-middle initial) McGuire, Roy W.					
January 16, 1927  YEARS  OF  EXPERIENCE  AS PRINCIPAL AS PRINCIPAL IN THIS FIRM IN OTHER FIRMS PRINCIPAL IN OTHER THAN IN OTHER FIRMS PRINCIPAL	DATE OF BIRTH (Month-day-year)  YEARS OF  March 30, 1923  YEARS OF  EXPERIENCE  7  8					
DUCATION (College, degree, year, specialization)	EDUCATION (College, degree, year, specialization)					
University of Illinois  B.S Architecture  M.S Architecture  MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS  American Institute of Architects	Western Michigan University Electrical Engineering MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS					
	None  REGISTRATION (Type, year, State) Michigan 1960; Ohio 1965					
REGISTRATION (Type, year, State) Illinois 1956						
Marsh, Walter R.	X NAME (Last-first-middle initial) Haynes, M.R.					
August 20, 1927	October 2, 1932  PARS OF EXPERIENCE  AS PRINCIPAL AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL  OCTOBER 3  OF 9					
Marquette University - B.S.M.E.	EDUCATION (College, degree, year, specialisation)					
University of Chicago - M.B.A.	Oregon State University B.S.E.E.					
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS  Illinois Society of Professional Engineers	MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS IEEE					
REGISTRATION (Type, year, State) Illinois 1965	REGISTRATION (Type, year, State) Oregon 1958; Colorado 1960					

(Purnish complete dat	CIPALS AND ASSOCIATES WITHIN YOUR FIRM a but keep to essentials)						
NAME (Last-first-middle initial)	BB NAME (Last-first-middle initial)						
Stone, G. D.	Boylan, J. W.						
ATE OF BIRTH (Month-day-year) YEARS AS PRINCIPAL AS PRINCIPAL OTHER THAN IN THIS FIRM IN OTHER FIRMSPRINCIPAL	DATE OF BIRTH (Month-day-year) YEARS AS PRINCIPAL AS PRINCIPAL OTHER THAT						
October 26, 1923 OF EXPERIENCE 3 6	February 22, 1928 EXPERIENCE 1 15 4						
EDUCATION (College, degree, year, specialization)	EDUCATION (College, degree, year, specialization)						
University of New Mexico B.S.M.E.	Newark College of Engineering M.S.M.E.						
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS	MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS						
ASHRAE Motor Works Adoptiation	American Society of Mechanical Engineers						
REGISTRATION (Type, year, State)	REGISTRATION (Type, year, State)						
New Mexico 1967; Colorado 1970	Pennsylvania 1962						
Harley, Robert S.	Neff. N. T.						
February 25, 1915  YEARS OF EXPERIENCE 7  AS PRINCIPAL AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL OF EXPERIENCE 7							
University of Colorado - B.S.A.E  University of Denver - School of Architecture & Planning							
MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS							
ASCE, ASPE, MSPE, OSPE, ASTME, CSPE, CSE, NCEE Certificate							
EGISTRATION (Type, year, State)	REGISTRATION (Type, year, State)						
Missouri 1965; Ohio 1966; Colorado 1971	Mech.: Pa. '55; Wisc., Ind. '61; Wash. '66; Cal., Ala. '6						
A NAME (Last-first-middle initial)	DD NAME (Last-first-middle initial)						
Spaite, P. W.	Gentzler, Gary L.						
ATE OF BIRTH (Month-day-year) YEARS OF OF EXPERIENCE 2  AS PRINCIPAL AS PRINCIPAL IN OTHER FIRMS PRINCIPAL OF EXPERIENCE 2  12 7	DATE OF BIRTH (Month-day-year) YEARS OF November 28, 1936  November 28, 1936  November 28, 1936  November 28, 1936						
DUCATION (College, degree, year, specialization)	EDUCATION (College, degree, year, specialization)						
Ohio State University - B.Ch.E.	Penn State University						
Salmon P. Chase School of Law - J.D.	B.S.E.S.						
Chemical Engineering and Chemistry Law	Ph.D Mechanical Engineering						
EMBERSHIP IN PROFESSIONAL ORGANIZATIONS AMERICAN Institute of Chemi	- MEMBERSHIP IN PROFESSIONAL ORGANIZATIONS						
cal Engineers, Air Pollution Control Association,	ASAE, ASHRAE, ASME, IFT						
American Chemical Society, Ohio Bar Association	o migharion (Type, page, State)						
EGISTRATION (Type, year, State)	REGISTRATION (Type, year, State)						
Ohio - Professional Engineer; Ohio - Attorney	Pennsylvania 1964						

5. CONTINUED	PERSON	IAL HISTOR	Y STATEMEN'	OF PRINC	IPALS AND ASSOCIATES WIT	THIN YOU	R FIRM	
ENAME (Last-first-middle ini	ial)	VITTLE ON	WHICH YOU	F1894 F6	NAME (Last-first-middle ini	tial)	THE BELLEVILLE	
Wiseman, John W.							OF RECEDING	
November 3, 1913	YEARS OF EXPERIENCE	S PRINCIPAL N THIS FIRM	AS PRINCIPAL IN OTHER FIRMS	OTHER THAN PRINCIPAL	DATE OF BIRTH (Month-day-year)	YEARS OF EXPERIENCE	AS PRINCIPAL IN THIS FIRM	AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL
					EDUCATION (College, degree, ye		instion)	
Ohio State Universi B.S.C.E.	ty		- E Causa	and	MEMBERSHIP IN PROFESSIONAL ORG		111111	
MEMBERSHIP IN PROFESSIONAL ORG Industrial Waste Asso Engineers; American V	ciation; Water Wor	Ohio Socies Associ	ciety of P	rofession	al.			
REGISTRATION (Type, year, State Ohio 1946; Colo	rado 197	1			REGISTRATION (Type, year, Stat	(e)		
. NAME (Last-first-middle in	itial)				NAME (Last-first-middle ini	itial)		
DATE OF BIRTH (Month-day-year)	YEARS OF EXPERIENCE	AS PRINCIPAL IN THIS FIRM	AS PRINCIPAL IN OTHER FIRMS	OTHER THAN PRINCIPAL	DATE OF BIRTH (Month-day-year)	YEARS OF EXPERIENCE	-	AS PRINCIPAL OTHER THAN
EDUCATION (College, degree, y	ear, special	ization)			EDUCATION (College, degree, ye	ear, specia	lization)	
MEMBERSHIP IN PROFESSIONAL OR	GANIZATIONS				MEMBERSHIP IN PROFESSIONAL ORG	GANIZATIONS		
REGISTRATION (Type, year, Sta	ite)				REGISTRATION (Type, year, State	te)		
. NAME (Last-first-middle in	nitial)				NAME (Last-first-middle in.	itial)		
DATE OF BIRTH (Month-day-year	YEARS OF EXPERIENCE	AS PRINCIPAL IN THIS FIRM	AS PRINCIPAL IN OTHER FIRM	OTHER THAN PRINCIPAL	DATE OF BIRTH (Month-day-year)	YEARS OF EXPERIENCE	AS PRINCIPAL IN THIS FIRM	AS PRINCIPAL OTHER THAN IN OTHER FIRMS PRINCIPAL
EDUCATION (College, degree,	year, specia	lization)			EDUCATION (College, degree, y	ear, specia	lisation)	
MEMBERSHIP IN PROFESSIONAL OF	RGANIZATIONS				MEMBERSHIP IN PROFESSIONAL OR	GAN I ZAT I ONS		
REGISTRATION (Type, year, St	ate)		takan m		REGISTRATION (Type, year, Sta	te)		
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NAME AND TYPE OF PROJECT	LOCATION	NAME AND ADI	DRESS OF OWNER	ESTIMATED CONSTRUCTION COST	PERCENT COMPLET
		Population	YOUR FIRST	Cler Property	1000
See Item 16, Addenda Page 8		-			

NAME AND TYPE OF PROJECT	LOCATION	YEAR YOUR WORK COM- PLETED	NAME AND ADDRESS OF OWNER	ESTIMATED CONSTRUCTION COST	STRUCT (Yes or No)
		- August			-
ee Item 18, Addenda Page 1	0				
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	or many from the control				
OTAL NUMBER OF COMPLETED PROJECT		TOTAL ESTI	MATED CONSTRUCTION COST:		-

	THE REST NAME OF TAXABLE	obstograph give the folio	YEAR	ESTIMATED CONS	STRUCTION COST OF	STRUCTED (Yes	FIRM
NAME OF PROJECT AND PHASE OF WORK	LOCATION	OWNER	YOUR WORK COM- PLETED	ENTIRE PROJECT	WORK FOR WHICH YOUR FIRM WAS RESPONSIBLE	(Yes or No)	ASSOCIATED WITH
	CT-VE TONE						
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NONE		, Inc.					
		olorado 80110 301-761-3522					
		inois 50076 312-676-3010					
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COMPLETED not to exceed 8 structure; (4) I	itectural work that are listed in items 3½"x11". On the back of each photog	traphs is optional. Where submitted, 18 and 19. (Photographs of models, raph give the following information: cific structure. Photographs of electric	renderings, sketches, etc., are N (1) Name of your firm; (2) Name ar	OT desired.) Size of photographs address of client; (3) Type of
21. A. CURRENT STAT	US (Check one) B. DEGREE OF	CLEARANCE   C. DATE OF CLEARANCE	D. CLEARED BY	E. HAVE PRINCIPALS BEEN CLEARED
SECURITY	ata are ruralshed in con	rection with Standard For	m 25, and the Sten nu	Clearances Inactive
(See Note d) ACTIVE	INACTI VE NONE			X YES NO
22 IN THE EVENT SPACES PRO	INCO ON THE EORN ARE NOT SHEELCHENT	FOR ENTRIES, OR IF YOU WISH TO FURNIS	W ADDITIONAL INFORMATION IT MAY	DE INCEDTED HEDE ON THE DEVENCE
OF THIS PAGE, OR ON SEPA	PRATE SHEETS, WITH APPROPRIATE REFERE	NCES.	ADDITIONAL INFORMATION, 11 MAI	be inserted here, on the revense
Item 6 (continu	ed) Branch Offices:			
Descut	A. M. Kinney, In	c.		NG.
	Bannock & Girard	Streets		
A R Plenney 2	Englewood, Color	ado 80110		
10 10 10 10 10 10 10 10 10 10 10 10 10 1	Telephone: 301-			ney, Jr.
to an anti-		701-3322		prend
TO THE REPORTS	C. L. Thomsen	- Operations		ris
R. D. Dictrick				Dir.
M. E. Hythewnor	A. M. Kinney Ass	ociates. Inc.		ORDER.
J. W. Morrella	4747 Dempster St			
- Thomas	Skokie, Illinois			
The second second				AP
No. 24 ALES	Telephone: 312-	676-3010		
R. W. DODGITE	H. A. Friedman			tter
No La Ruter				
Item 21 (contin	ued) Many principals principals in ot	in A. M. Kinney, Inc., an her companies.	d Processes Research,	Inc. Some
23.	PURPOSE OF SUBMIT	TING THIS QUESTIONNAIRE (Ch	eck A or B. not both)	
23,	7 0111 002 01 0021111	The thire description is the	~	
	nsidered for architectural or engineer action projects for Federal Agencies	ing services in connection with the	X design, X inspection, X su	upervision (check applicable box
			NAME OF FIRM AS	SOCIATED WITH
B. This completed que (See item 12.)	estionnaire is submitted as evidence	of employment as outside associate o	r consultant.	
As	of this date: May 5,	1972 the foregoi	ng is a true statement of	facts.
NAME OF FIRM OR INDIVIDUAL S	UBMITTING QUESTIONNAIRE	TYPE NAME AND TITLE OF PERSON S	SIGNING SIGNATURE	0111
A. M. K.	INNEY, INC.	R, L. Ahlbrand, Pres	ident	allellen
NOTES: (b) It will be to a firm	npleted by typewriter. Completed for eemed necessary to meet distribution n's advantage to maintain its experier be accomplished by periodically forw	requirements. nish s ace record on a current tants.	OT necessary for individuals or fi eparate questionnaires for their or It is for consideration only with re	utside associates and consul-

STANDARD FORM 251

### ADDENDA

The following data are furnished in connection with Standard Form 251, and the Item numbers correspond to those contained herein.

Item 7.

#### ORGANIZATION DATA

### A. M. KINNEY, INC.

#### Executive Officers

A.	M.	Kinney, Jr.	Chairman of the Board
		Ahlbrand	President
L.	P.	Kirwin	Vice President - Operations
R.	D.	Blotter	Vice President - Project Coordination
M.	E.	Mathewson	Vice President and Secretary
		Morris	Vice President and Treasurer
C.	L.	Thomsen	Vice President Vice President
		Wier	Vice President
		McGuire	Vice President
		Ruter	Administrative Vice President
		Smith	Controller : TECHLAR INC.

### Directors

A. M. Kinney, Jr.
R. L. Ahlbrand
J. R. Morris
M. L. Ruter
C. L. Thomsen
L. P. Kirwin
D. R. Miller
G. A. Smith
R. D. Blotter

### PROCESSES RESEARCH, INC.

# Executive Officers

		Kinney, Jr.	Chairman of the Board	Α.	M.	Kinney, Jr
D.	R.	Miller	President			Miller
M.	R.	Jester	Executive Vice President			Jester
E.	N.	Woistmann	Senior Vice President			Woistmann
V.	H.	Schnebel	Vice President - Chemical Plant Design			Mathewson
J.	D.	Burt	Vice President - Plant Layout			Smith
H.	F.	Knight, Jr.	Vice President			Howe
J.	M.	Brooks	Vice President			Morris
J.	S.	Friedman	Vice President			Burt
M.	L.	Ruter	Administrative Vice President			Ahlbrand
M.	E.	Mathewson	Secretary	100	٠,	milbrand
J.	R.	Morris	Treasurer			
G.	Α.	Smith	Controller			

NOTE: The Directors in both corporations are the controlling stockholders. There are no stockholders who are not employed by the companies and actively engaged in their operation as of the above date.

### TECHLAB, INC.

Executive	Officers
-----------	----------

A. M. Kinney, Jr. Chairman of the Board and President
J. R. Morris Secretary and Treasurer

#### Directors

Directors

A. M. Kinney, Jr. J. R. Morris J. W. Wiseman

J. W. Witches

## A. M. KINNEY ASSOCIATES, INC.

### Executive Officers

A. M. Kinney, Jr. Chairman of the Board H. A. Friedman President

W. R. Marsh Executive Vice President

J. H. Omarzu Vice President
G. A. Smith Secretary
J. R. Morris Treasurer

### Directors

A. M. Kinney, Jr.

H. A. Friedman

J. H. Omarzu

J. R. Morris

W. R. Marsh

R. L. Ahlbrand D. R. Miller

# A. M. KINNEY ASSOCIATES, WILLIAM J. RABON

#### Partners

W. J. Rabon

J. R. Morris

H. A. Friedman

J. H. Yuan

R. L. Ahlbrand

H. Roomann

J. H. Lund

## Item 8. ASSOCIATE MEMBERS OF FIRMS:

R. P. Ballard

M. L. Mascia

L. A. Prusiner

W. H. Settle

E. B. Woodruff

J. W. Cunningham

S. M. Gleser

E. H. Zwertschek

I. M. Reznor

N. T. Neff

A. H. Zipperstein

R. T. Howe

L. M. Pockras

C. M. Jones

J. W. Wiseman

D. L. Reeder

Item 9. The designation of "FM" and "AFM" after names appearing in this list of key personnel denotes "Firm Member" or "Associate Firm Member."

(a)	Architects		Project Architects
	W. J. Rabon, Architectural	FM	J. H. Cruthis E. H. Zwertschek
	Partner		E. Schranz J. T. Rudy
	H. Roomann, Architectural	FM	F. Comber G. L. Nielsen
	Partner		H. T. Fink G. W. Froelich
	J. H. Lund, Architectural	FM	G. A. Zellers
	Partner		
	L. A. Prusiner, Project Manager	AFM	Section Chiefs
	J. A. Herrmann, Project Manager	AFM	O R Mak Should Manufact Manufact
	H. A. Friedman, Director	FM	M. J. Wolfson R. Reeder
	J. H. Omarzu, Project Manager	FM	G. Brabender
	W. A. Connolly, Director,	AFM	J. S. Water neuting, ventilet:
	Architectural Specifications		Project Engineers
	R. W. Masterson, Director	AFM	D. F. Darressian Constitution of the
	P. J. Bradtke, Project Manager	AFM	D. L. Stuckenberg F. Samame
	1, 0, 2244,00, 129,000		F. C. Eleman J. R. Martin
(b)	Included with above		R. W. Hyre J. P. Huller
(2)	Was March Decker Manager		T. P. Semancik C. Wilhelm
(c)	Civil Engineers		W. L. Long G. P. Grant
(0)	OTTI DIGINOUS		
	J. R. Morris, Director	FM	Section Chiefs
	L. M. Pockras, Deputy Director	AFM	
	J. H. Yuan, Chief, Research and	AFM	J. E. Henry A. E. Wall
	Development		A. W. Pfirrmann
	D. C. Bell, Assistant Director,	AFM	
	Research & Development - Structural		
	R. P. Ballard, Project Manager	AFM	
	W. H. Settle, Project Manager	AFM	
	J. C. Overmann, Project Manager	AFM	
	F. L. Krieger, Director, Soils	AFM	
	Laboratory		
	J. W. Cunningham, Project Manager	AFM	
	L. W. Franz, Director	AFM	

#### (d) Included with above

## (e) Sanitary Engineers

J. W.	. Wiseman,	AFI
Dire	ector Manager	
D. G.	. Uetrecht	AFI
Mach	anical Engineens	

### (f) Mechanical Engineers

R.	C.	Wier, Director	FM
M.	E.	Mathewson, Technical Expert	FM
R.	S.	Harley, Project Manager	AFM
W.	T.	Ferguson, Chief of Design,	AFM
H	eat:	ing, Ventilating, & Air	
C	ond:	itioning	
C.	E.	Steele, Chief of Design,	AFM
P.	Lum	bing, Piping, & Fire Protection	
J.	F.	Luhan, Project Manager	AFM
W.	R.	Kelley, Project Manager	AFM
G.	D.	Stone, Project Manager	AFM
		Marsh, Project Manager	FM
D.	L.	Reeder, Director, Specifications	AFM
		Gleser, Specifications	AFM
J.	H.	Sandaker, Chief Estimator	AFM
G.	L.	Gentzler, Project Manager	AFM

## Section Chiefs (Mechanical)

J.	C.	McCaskill	D.	A.	Orrell
D.	E.	Anderson	R.	E.	Cole
T.	A.	Durham			

## Project Engineers (Mechanical)

1.	G.	Angerman	Heating, Ventilating, & Air Conditioning, & Fire Protection
3.	L.	Williams	Heating, Ventilating, & Air Conditioning, & Fire Protection
	Α.	Smith	Heating, Ventilating, & Air Conditioning, & Plumbing
	S.	Норре	Heating, Ventilating, & Air Conditioning, & Plumbing
	G.	Wohlfarth	Heating, Ventilating, & Air Conditioning, & Plumbing
	s.	Katz	Heating, Ventilating, & Air Conditioning
	F.	Darrenkamp	Heating, Ventilating, & Air Conditioning, & Plumbing
	c.	Marsh	Heating, Ventilating, & Air Conditioning
	R.	Gast	Heating, Ventilating, & Air Conditioning

Power and Nuclear	Department Engineer	8	Project E	ngineers (Power & Nuclear)
J. Y. Wang, Techn P. C. Quo, Deputy N. T. Neff, Proje	Director	AFM AFM AFM	E. B. Woodruff H. T. Kimball, Jr.	Power Plants Power Plants
J. W. Boylan, Pro	ject Manager	AFM	Section	Chiefs (Power & Nuclear)
Electrical Engine	ers deal barbana		R. A. Braun	N. W. Okel
R. W. McGuire, Di N. Merle, Deputy	Director	AFM AFM	Project E	ngineers (Electrical)
M. R. Haynes, Pro J. E. Newcomer, S		AFM AFM	C. H. Monnig	Utility & Distribution Systems
Section Chi	efs (Electrical)		H. C. Tecklenburg	Lighting, Power, & Distribution Systems
D. B. Platt	D. J. Boyle		S. Zackerman	Lighting, Power, and Automatic Control
J. A. Reid R. J. Hardcorn	G. Cooper D. E. Dale		R. M. Langdon	Lighting, Power, & Distribution Systems
L. A. Post D. J. Fugazzi	H. J. Pisciotta W. B. Enyart		R. L. Dudley	Lighting, Power, & Distribution Systems
n) Planner			N. L. Meyers	Control & Instru- mentation Systems
W. J. Rabon	Site, City,	FM	J. W. Wallace	Power & Distribution Systems
	Town, Community		C. M. Shekro	Power & Distribution Control Systems
i) Environmental Cor			R. M. East	Instrumentation, Power & Control Systems
P. W. Spaite C. K. Miller	Director	AFM AFM	G. W. Pahl	Power Distribution & Control Systems
			H. W. Noack	Power Distribution & Control Systems
			R. E. Babcock	Lighting, Power, & Distribution Systems
			A. Buchel	Power & Lighting Distribution

# (j) Other Engineers

M.	L.	Mascia, Director, Field Supervision	
R.	T.	Howe, Mechanical Engineering, Plant Planning	AFM
I.	M.	Reznor, Chemical Engineering	FM
A.	Н.	Zipperstein, Chemical Engineering	AFM
V.	H.	Schnebel, Chemical Engineering	AFM
W.	D.	Beers, Chemical Engineering	AFM
G.	D.	Maddocks, Chemical Engineering	AFM
D.	J.	Nourie, Instrumentation	AFM
F.	W.	Schrimper, Chemical Engineering	AFM
E.	J.	Goldsberry, Machine Design	AFM
T.	C.	Fisher, Instrumentation	AFM
B.	H.	Steinhard, Machine Design	AFM
P.	G.	Koconis, Field Supervision	AFM
C.	M.	Jones, Chemical Engineering	AFM
K.	W	Deem, Chemical Engineering	AFM
R.	E.	McWhirter, Industrial Planning	AFM
C.	E.	Pruiss, Chemical Engineering	AFM
C.	0.	Bieser, Industrial Planning	AFM
S.	P.	Klosky, III, Chemical Engineering	AFM
В.	D.	Cox, Chemical Engineering	AFM
M.	н.	Nerzig, Industrial Engineering	AFM
R.	I.	Tarver, Chemical Engineering	AFM
G.	N.	Thomas, Chemical Engineering	AFM
H.	J.	Helm, Jr., Chemical Engineering	AFM
E.	J.	Bissaillon, Chemical Engineering	AFM
E.	P.	Lynch, Chemical Engineering	AFM
R.	B.	Vice, Jr., Industrial Planning	AFM
	-	. 200, or., industrial rianning	AFM

Item 16. The following listing of present activities on which we are designated Architect or Engineer of record is limited to those projects on which we are currently engaged for the United States Government. Our present overall activities include a total of 40 projects, involving an estimated construction cost of \$201,100,000, and the design phase of these projects is approximately 76 percent complete.

Fatimated

Name and Type		Name and Address	Estimated Construction		cent
of Project	Location	of Owner	Cost	Design -	Field Supv.
Continuing Consulting Service Contract for Evaluation of Process Techniques for the Removal of SO <sub>2</sub> and Other Pollutants From Waste Gas Streams	Cincinnati, Ohio	Environmental Protection Agency, Office of Air Programs			
Technical Evaluation Study - TNT Red Water Condensate Waste	Joliet Army Ammunition Plant, Illinois	U. S. Army Engineer District, Omaha, Nebraska			
Development of Air and Waste Water Pollution Control Program	Radford, Virginia	U. S. Army Engineer District, Baltimore, Maryland			
American Museum of Atomic Energy	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	\$ 2,900,000	35	
Design of Three Continuous TNT Lines FY 69 Program	Joliet Army Ammunition Plant, Illinois	U. S. Army Engineer District, Omaha, Nebraska	21,000,000	98	75
Design of Three Continuous TNT Lines FY 72 Program	Joliet Army Ammunition Plant, Illinois	U. S. Army Engineer District, Omaha, Nebraska	18,500,000	95	

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Con	ercent mpleted - Field Supv.
Design of Three Continuous TNT Lines FY 71 Program	Volunteer Army Ammunition Plant, Chattanooga, Tennessee	U. S. Army Engineer District, Mobile, Alabama	\$ 18,500,000	98	
Modernization Plan for Three Continuous TNT Lines and Support Facilities FY 70 Program	Volunteer Army Ammunition Plant, Chattanooga, Tennessee	U. S. Army Engineer District, Mobile, Alabama	18,000,000	98	35
TNT Bulk Handling Facilities - Production Equipment and Installation	Volunteer Army Ammunition Plant, Chattanooga, Tennessee	ICI America, Inc.	6,000,000	5	-
Pollution Abatement Facilities - Acid Plant Waste - FY 70 Program	Joliet Army Ammunition Plant, Illinois	U. S. Army Engineer District, Omaha, Nebraska	2,000,000	80	
TNT Bulk Handling Facilities - Site and Building Work	Volunteer Army Ammo Plant Chattanooga	U. S. Army Engineer District, Mobile, Alabama	1,500,000	5	
Propulsion Engineering Training Building (NORDIVNAVFACENGCOM) (2)	Great Lakes, Illinois	U. S. Navy, Philadelphia	9,000,000	100	2
Distribution Facility	Denver, Colorado	U. S. Public Health Service	1,700,000	100	60

Item 18. Completed Work on Which We Were Designated Architect or Engineer of Record:

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Modification to Bldg. 824 for Dynamic Shock Tester Installation	Wright- Patterson AFB, Ohio	U. S. Air Force	\$ 100,000	1971	Yes
Visual Approach Slope Indicator Airfield Lighting System	Bunker Hill AFB, Ind.; Wurtsmith AFB, Oscoda, Mich.	U. S. Air Force	104,000	1963	Yes
Survey and Report on Electrical Distribution System in the Base and Housing Areas	Bunker Hill AFB, Indiana	U. S. Air Force	250,000	1968	No
Headquarters 4950th Test Wing (Technical) (AFSC):  Relocation of 5 Computer Systems to Bldg. 676	Wright- Patterson AFB, Ohio	U. S. Air Force	271,000	1971	Yes
Relocation of CDC 1700 Remote Computer					
Feasibility Study for Ceiling Radiation Shielding					
Modifications to Electric Service	Grissom AFB, Indiana	U. S. Air Force	850,000	1969	Yes
Toxic Laboratory	Wright- Patterson AFB, Ohio	U. S. Air Force	1,400,000	1967	
Criteria Study for Aerospace Medical Laboratory	Wright- Patterson AFB, Ohio	U. S. Air Force	2,000,000		No

Name and Typeof Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Conceptual Design Biological Research Laboratory	Oak Ridge, Tennessee	U. S. Atomic Energy Commission		1966	
Automatic Conveying System for Waste Paper Scrap, Building No. 1916-TI	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	\$ 5,000	1963	Yes
Atomic Blast Emergency Shelter (Study)	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	30,000	1964	No
Outdoor Exhibit Area for Oak Ridge Institute of Nuclear Studies	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	35,000	1963	Yes
Modifications to Building No. 1916-TI	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	50,000	1963	Yes
Standard Plans for Emergency Duty Personnel Shelters	Various Areas Within U.S.A.	U. S. Atomic Energy Commission	100,000 Each	1963	Yes
Revisions to Organic Modulated Power Reactor	Piqua, Ohio	U. S. Atomic Energy Commission	150,000	1966	Yes
Additional Air Conditioning Building 212 (2)	Argonne National Laboratories, Illinois	U. S. Atomic Energy Commission	250,000	1967	Yes
Computer, Water Treatment, Warehouse Facility, and Waste Material Staging Center	Miamisburg, Ohio	U. S. Atomic Energy Commission	300,000	1965	Yes
Explosives Component Fabrication Facility	Miamisburg, Ohio	U. S. Atomic Energy Commission	325,000	1968	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Special Metallurgical Facility	Miamisburg, Ohio	U. S. Atomic Energy Commission	\$ 350,000	1964	Yes
Bombproof Communication Center (Preliminary Design)	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	500,000	1964	Yes
Virus Control Laboratory	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	1,200,000	1965	Yes
Final Design for Additional Facilities, Mound Laboratories: Timer Fabrication Facility Transducer Fabrication Facili Surveillance & Environmental Testing Facility		U. S. Atomic Energy Commission Albuquerque Operations	2,850,000	1969	
Analytical Fabrication Facility South Additions and Alterations to "M" Building				1970 1970	
Co-Carcinogenesis Research Laboratory - Conceptual Design	Oak Ridge, Tennessee	U. S. Atomic Energy Commission	3,800,000	1965	Yes
Preliminary Design for Additional Facilities, Mound Laboratories:	Miamisburg, Ohio	U. S. Atomic Energy Commission Albuquerque Operations			
Surveillance Testing Facility Portion of New Weapons Produc Capacility, Consisting of:			400,000	1968	
Analytical Facility			650,000	1968	
Transducer Fabrication			400,000		
Timer Fabrication Facility	7		700,000	1968	
Crafts Shop Building			850,000		
Alterations to Existing "M" Building, Precision Machine Operations			700,000	1968	

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Flood Protection Survey Reports	Crocksville, Ohio	U. S. Corps Engineers Huntington District		1965	No
Flood Protection Survey Reports	Ironton, Ohio	U. S. Corps Engineers Huntington District		1965	No
Flood Protection Study and Report	Delhi, New York	U. S. Corps Engineers Philadelphia District		1967	
Defense Supply Agency FY 70 Warehouse Lighting Projects	Richmond, Virginia	U. S. Corps Engineers Baltimore District	\$ 250,000	1972	
Defense Supply Agency FY 70 Warehouse Lighting Projects	Columbus, Ohio	U. S. Corps Engineers Baltimore District	250,000	1972	
Additional Laboratory Space - Building No. 450	Wright- Patterson AFB, Ohio	U. S. Corps Engineers Louisville District	300,000	1963	Yes
Standard Design Plans for 200 and 400-Man Armory	Huntington, West Va.	U. S. Corps Engineers Huntington District	550,000	1965	
15,000 KVA, 69 KV to 12.5 KV Substation and Associated Transmission & Distribution Lines	Wright- Patterson AFB, Ohio	U. S. Corps Engineers Baltimore District	750,000	1971	
Alterations to Pumping Station	Parkersburg, West Va.	U. S. Corps Engineers Huntington District	1,300,000	1965	Yes
Field Investigation and Report and Final Plans, Specifica- tions, Surveys, and Foundation Investigation for Utilities Relocation for High Level Dam; Preparation and Supervision of Television Contract	Parkersburg, West Va.	U. S. Corps Engineers Huntington District	1,500,000	1964	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Final Plans, Specifications, Surveys, and Foundations Investigations	Parkersburg, West Va.	U. S. Corps Engineers Huntington District	\$ 1,650,000	1967	
Outlet Works	Caesar Creek Reservoir, Ohio	U. S. Corps Engineers Louisville District	2,000,000	1970	Yes
Final Study; Reconnaissance Systems Integration and Evaluation Facility	Wright- Patterson AFB, Ohio	U. S. Corps Engineers Louisville District	2,086,000	1968	No
Flood Control Report	Portsmouth, New Boston, Ohio Areas	U. S. Corps Engineers Huntington District	3,200,000	1968	No
Criteria Study - Aerospace Medical Impact Research Facility	Wright- Patterson AFB, Ohio	U. S. Corps Engineers Louisville District	3,800,000	1967	
Headquarters Command Building	Wright- Patterson AFB, Ohio	U. S. Corps Engineers Louisville District	5,000,000	1963	Yes
Materials Research Laboratory	Wright- Patterson AFB, Ohio	U. S. Corps Engineers Louisville District	5,000,000	1965	No
Computer Analysis of Backwater Curves	Evansville, Indiana	U. S. Corps Engineers Louisville District			
Portions of Opekiska Dam	Monongahela River, W.Va.	U. S. Corps Engineers Pittsburgh District	1,000,000	1963	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
445,000 gpm High-pressure Industrial Water Pumping Facility, 50,000 #/hr High Temperature Hot Water Heat- ing Plant and 6,000 KW Diesel- driven Generating Plant, Missile Test Site	Pearl River, Mississippi	U. S. Corps Engineers Mobile District	\$ 7,000,000	1964	Yes
Pike Island Navigation Dam	Pike Island	U. S. Corps Engineers Pittsburgh District	15,000,000	1963	Yes
Maxwell Dam, Monongahela River	Pennsylvania	U. S. Corps Engineers Pittsburgh District	16,000,000	1963	Yes
Experimental Industrial and Sanitary Waste Treatment Pilot Plant with Activiated Sludge and Trickling Filter Features	Cincinnati, Ohio	U. S. Department of the Interior - Federal Water Pollution Control Administration	100,000	1968	
Plant Utilities Study	Columbus, Ohio	Department of the Navy Fourth Naval District		1962	
Alterations to Quality Control Laboratory, Inertial Guidance Maintenance Facility	Newark AFB, Ohio	U. S. Navy, East Central Division	218,000	1969	
Additional Logistics Facility, Inertial Guidance Maintenance Facility	Newark AFB, Ohio	U. S. Navy, East Central Division	306,000	1969	
Building Modifications to Post Office Annex	Cincinnati, Ohio	U.S. Post Office Department	250,000	1965	Yes
U. S. Post Office Terminal Annex and Garage (1)	Cincinnati, Ohio	U. S. Post Office Department	7,000,000	1963	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Uninterruptible Emergency Electric Power Generator	Dayton, Ohio	Defense Electronics Supply Center	\$ 135,000	1963	Yes
Alterations and Improvments on U. S. Post Offices (2)	Eighteen Locations	General Services Administration	3,000,000	1971	Yes
Building Modifications to Post Office Annex	Cincinnati, Ohio	General Services Administration	5,700,000	1966	Yes
Environmental Control Laboratory	Cincinnati, Ohio	General Services Administration, for Environmental Protection Administration Dept. of Health, Education & Welfare	20,000,000	1971	No
285,000 gpm High-pressure Industrial Water System, Missile Test Facility	Huntsville, Alabama	National Aeronautics and Space Administration	3,500,000	1963	Yes
Study for Plastic Radar Tower Sunshield	Middletown, Ohio	Aeronca Manufacturing Corporation		1965	
Survey, Steam Generation Facilities and Distribution System	Louisville, Kentucky	Lorillard Corporation		1966	
Study of Requirements for Pickle Liquor Recovery System	Massillon, Ohio	Republic Steel Corporation		1966	
Paper Machine No. 6 Rebuild	Hamilton, Ohio	Champion Paper Company		1964	Yes
Study and Report - Proposed Improvement of Riverfront Facilities	Cincinnati, Ohio	Monsanto Company		1966	

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Master Plan, Biological Research Laboratory, Building Alterations (2)	Skokie, Illinois	G. D. Searle & Co.		1962	
Survey & Report - Electrical Distribution & Compressed Air Systems	Cincinnati, Ohio	Steelcraft Manufacturing Company		1965	
Feasibility and Cost Study - Consolidation of Computer Facilities	Cincinnati, Ohio	General Electric Company		1967	
Feasibility Study of Expansion of Research & Development Facility	Evendale, Ohio	Formica Corporation		1965	
Master Plan for Pharmaceutical and Drug Products Plant	Memphis, Tennessee	Plough, Inc.		1963	Yes
Master Plan, Engineering and Science Campus (1)	Cincinnati, Ohio	University of Cincinnati		1963	Yes
Coal & Ash Handling System	Owensboro, Kentucky	Field Packing Company		1965	Yes
Systems for Conditioning Supply Air to Laminar Flow Hoods	Melbourne, Florida	Harris Semiconductor Div.		1971	Yes
Universal Combustion Safeguards System	Augusta, Ga., Mongtomery, Alabama, Memphis, Tenn. Corinth, Miss. Little Rock, Ar	,		1963	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con-
Sedimentary Waste Retention Basin	Charleston, West Va.	F.M.C. Corporation		1963	Yes
Sanitary Sewer	North Chicago, Illinois	Abbott Laboratories		1964	Yes
Drainage Retention Structures	Middletown, Ohio	City of Middletown, Ohio		1965	Yes
Waste Acid Disposal System Phase II	New Martins- ville, W.Va.	Mobay Chemical Company		1962	Yes
Sanitary Sewer Extension, Pump Station, and Force Main	Bethel, Ohio	City of Bethel, Ohio			No
Boiler Plant Addition	Cincinnati, Ohio	The Wm. Powell Company		1964	Yes
Survey of Handling in Service Area	Huntington, West Va.	International Nickel Co., Inc., Huntington Alloy Div		1966	
Building Addition P9, Water Treatment Building (2)	North Chicago, Illinois	Abbott Laboratories		1967	Yes
Water Storage Facility	Indian Hill, Ohio	Village of Indian Hill, Ohio		1964	Yes
Retention Basin Scheme, University Boulevard	Middletown, Ohio	City of Middletown, Ohio		1967	Yes
Animal Building Expansion	Cincinnati, Ohio	The Procter & Gamble Company		1972	Yes
Electrical Work for Renovation of Paper Machine No. 5	Hamilton, Ohio	Champion Papers, Inc.		1963	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Animal Facilities, Revisions to Parasitology Facility, & New Agricultural Organic Chemical Research Laboratory	Greenfield, Indiana	Eli Lilly and Company		1965	Yes
Boiler House & Service Loop (2)	Muskegon, Michigan	Ott Chemical Company		1967	
Clinical Research Center (1)	Cincinnati, Ohio	Children's Hospital		1964	Yes
Chemistry Addition to Feed Additives Laboratory	Ashland, Ohio	Hess & Clark, Inc.		1965	Yes
Office Building (1)	Fostoria, Ohio	Ford Motor Company General Parts Division		1965	Yes
Biology Center Laboratory Building (2)	Wind Point, Wisconsin	S. C. Johnson & Company, Inc.		1965	No
Chlorine Liquefaction Plant	Calvert City, Kentucky	Pennwalt Chemical Corporation		1963	Yes
Expansion of Foundry Building	Cincinnati, Ohio	Sawbrook Steel Castings Co		1962	Yes
Feasibility Report for Water Reservoirs (5)	Clark County, Indiana	Indiana Flood Control & Wa Resources Commission, Indianapolis, Indiana	ter	1963	
Phenyl Tetramer Plant	Schenectady, New York	General Electric Company		1964	Yes
Petrochemical Plant	Doe Run, Kentucky	Olin Mathieson Chemical Corporation		1965	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
General Offices (1)	Dayton, Ohio	Otterbein Press		1965	Yes
Camping & Picnic Areas	Cowan State Park, Ohio	Ohio Department of Natural Resources		1965	Yes
Filling and Packaging Addition	Kansas City, Missouri	Jensen Salsbery Labora- tories Div., Richardson- Merrell, Inc.	\$ 1,000,000	1971	Yes
Sewage Treatment Plant and Associated Collection System (1)	Alexandria, Kentucky	City of Alexandria, Kentucky	1,000,000	1964	No
Low Temperature Chemical Manufacturing Facility (4)	Holland, Michigan	Parke, Davis & Company	1,000,000	1964	Yes
Meat Handling and Freezer Facility (2)	Marshalltown, Iowa	Swift and Company	1,000,000	1965	Yes
Electronics Manufacturing Plant	Cincinnati, Ohio	Bendix Corporation	1,020,000	1962	Yes
Vaccine Laboratory	North Chicago, Illinois	Abbott Laboratories	1,200,000	1965	Yes
Controlled Temperature and Humidity Storage and Build- up Areas	Coshocton, Ohio	General Electric Company Laminated Products Div.	1,200,000	1967	Yes
Synthetic Chemical Plant	Summit, New Jersey	CIBA Pharmaceutical Products, Inc.	1,300,000	1965	Yes
Central Chilled Water Facilities - 3,500-ton Capacity (5)	Lafayette, Indiana	Purdue University	1,500,000	1963	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Expansion of R & D Facilities	Cincinnati, Ohio	Formica Corporation Sub., American Cyanamid Corp.	\$ 1,500,000	1969	Yes
Remodeling of Banking Facilities	Cincinnati, Ohio	Central Trust Company	1,500,000	1969	Yes
Manufacturing Plant and Office Building	Covington, Kentucky	R. A. Jones & Company, Inc.	1,500,000	1964	Yes
Office, Laboratory, and Manufacturing Facilities	Memphis, Tennessee	Plough, Inc.	1,600,000	1965	Yes
100,000 #/hr, 450 psig Oil- fired Boiler, 60,000 Gal. Underground Fuel Oil Storage Capacity, Including Mechani- cal Dust Collectors For Existing Boiler and New Boiler	Baltimore, Maryland	The Procter & Gamble Company	1,165,000	1971	Yes
Installation of Dust Collectors on Two Existing Steam-fired Boilers and Two Electrostatic Precipitators on Two Existing Pulverized Coal-fired Boilers	Cincinnati, Ohio	The Procter & Gamble Company	1,800,000	1971	Yes
300,000 #/hr - 500 #/sq.in. 1650F Boiler (1)	Toms River, New Jersey	Toms River Chemical Corporation	1,950,000	1963	Yes
Biological Research Laboratory	Cincinnati, Ohio	The Wm. S. Merrell Company	2,000,000	1964	Yes
Expansion of Gas Handling Facilities	Toledo, Ohio	Standard Oil Company (Ohio)	2,000,000	1970	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Remodeling of Pediatric Research & Clinic Building	Cincinnati, Ohio	Children's Hospital	2,000,000	1968	No
Fiber Recovery for City of Franklin, Ohio (Solid Waste	Franklin, Ohio	Black Clawson Company, Shartle Division	2,000,000	1969	Yes
Recovery Plant)					
Design for Nuclear Reactor Research Laboratory	Cincinnati,	University of Cincinnati	2,000,000	1964	No
Research haboratory	Foley				
Portion of State Route	Montgomery County, Ohio	State of Ohio Department of Highways	2,000,000	1963	Yes
New Chanfigal Plant	Sheronville,	Dubois Chemical Division,			Yes
Expansion of Existing Organic Chemical Pilot Plant Facilities	Cranston, R. I.	Geigy Chemical Corporation	2,000,000	1969	Yes
Chemical filot flamt facilities	Alemantra .			1953	
Technical Research Center	Columbus, Ohio	Ross Laboratories Div., Abbott Laboratories	2,500,000	1965	Yes
	Cincimuti				
Manufacturing Plant	Cincinnati, Ohio	The Wm. S. Merrell Company	3,000,000	1965	Yes
Master Plan - Remodeling of Office Building	Cincinnati, Ohio	Cincinnati & Suburban Bell Telephone Company	3,000,000	1967	No
Manufacturing Support Building	Lexington, Kentucky	International Business Machines	3,000,000	1971	Yes
Waste Treatment Expansion	Lafayette, Indiana	Eli Lilly and Company	3,000,000	1971	Yes
New Boiler Installation	Green Bay, Wisconsin	The Procter & Gamble Compan Paper Products Division	y 4,000,000	1966	Yes
New Boiler Plant	Freehold, New Jersey	Nestle Company, Inc.	4,000,000	1969	Yes

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
Phase I of New Boiler Plant 215,000 #/hr - 650 #/sq.in. 835F - and Steam, Electrical, and Water Distribution System (5)	Lafayette, Indiana	Purdue University	\$ 4,685,000	1963	Yes
Steam & Electrical Generating Facility (5)	Lafayette, Indiana	Purdue University	5,000,000	1967	Yes
Black Liquor Recovery Boiler	Foley, Florida	The Procter & Gamble Company	5,000,000	1965	Yes
New Chemical Plant	Sharonville, Ohio	DuBois Chemical Division, W. R. Grace & Co.	5,000,000	1966	Yes
Synthetic Detergent Manufacturing Plant	Augusta, Georgia	The Procter & Gamble Company	7,000,000	1963	Yes
Resin Plant and Paper Convert- ing Facility for Laminated Plastics Plant	Cincinnati, Ohio	Formica Corporation, Sub. American Cyanamid Company	7,000,000	1964	Yes
New Research Facilities	Mt. Vernon, Indiana		7,500,000	1972	Yes
Expansion - Miami Valley Laboratories	Cincinnati, Ohio	The Procter & Gamble Company	7,500,000	1972	Yes
Organic Manufacturing Facilities	Kingsport, Tennessee	Tennessee Eastman Company	7,900,000	1967	Yes
Fermentation Expansion		Eli Lilly and Company			
Preliminary Study, Laboratory, and Chemical Manufacturing Facilities	Indianapolis, Indiana	Pitman-Moore Company	12,000,000	1965	

Name and Type of Project	Location	Name and Address of Owner	Estimated Construction Cost	Year	Con- structed
23-Mile Reach Interstate Route 71	Warren, Clinton, & Greene Counties	State of Ohio Department of Highways	\$ 14,800,000	1963	Yes.
Engineering Science Complex	Cincinnati, Ohio	University of Cincinnati	17,000,000	1970	Yes
Master Plan for Manufacturing, Finishings, and Warehousing Facilities	Chicago, Illinois	Abbott Laboratories	17,000,000	1967	
Food Processing Plant	Lafayette, Indiana	General Foods Corporation	18,000,000	1970	Yes
Expansion & Modernization of Nylon & Polymer & Fiber Production Plant (1)	Hopewell, Virginia	Allied Chemical Corporation	25,000,000	1966	Yes

<sup>(1)</sup> Our affiliate, A. M. Kinney Associates, was the A-E firm with which the client had the contract on this project. We performed the major portion of the engineering work on it under subcontract.

<sup>(2)</sup> Our Illinois affiliate, A. M. Kinney Associates, Inc., was the A-E firm with which the client had the contract on this project.

<sup>(3)</sup> Our affiliate, A. M. Kinney Associates, William J. Rabon, was the A-E firm with which the client had the contract on this project.

<sup>(4)</sup> Our Michigan affiliate of the same name was the A-E firm with which the client had the contract on this project. The bulk of the work on the project was, however, performed by us under subcontract.

- (5) Our Indiana affiliate of the same name was the A-E firm with which the client had the contract on this project. The bulk of the work on the project was, however, performed by us under subcontract.
- (6) Our affiliate, Kintech Services, Inc., was the firm with which the client had the contract on this project.

BUREAU OF THE MINT
THE DEPARTMENT OF THE TREASURY

UNCLASSIFIED

2021616, S & E

F. H. MAC DONALD

JUNE 6, 1972

964 5877

A/E Selection

JAMES M. PHELAN
A. T. KEARNEY, INC.
100 S. WACKER DRIVE
CHICAGO, ILLINOIS

THIS IS TO ADVISE YOU THAT PRESENTATIONS FOR PROFESSIONAL SERVICES TO BE ASSOCIATED WITH DESIGN OF A NEW DENVER MINT ARE ACCOMMODATED BY THE GENERAL SERVICES ADMINISTRATION.

THAT AGENCY ALSO IS RESPONSIBLE FOR THE SELECTION OF THE PROFESSIONAL SERVICES CONTRACTOR. WE HAVE BEEN ADVISED THAT SELECTION IS IMMINENT.

[Signed] F. H. MacDonald

F. H. MAC DONALD ACTING DIRECTOR OF THE MINT

cc: Mr. Rhea

O NNOBAZ CON 157NN305042)PD ATKCO COO ZOZO 30 PD CHICAGO ILL MRS MARY T BROOKS, DIRECTOR BUREAU OF THE MINT 15TH STREET AND PENNSYLVANIA AVENUES, N.V. WASHINGTON, D.C.

A/E

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SS. HY

IN CONNECTION WITH THE CONSTRUCTION OF THE NEW DENVER MINT, KEARING IS A SUBCONTRACTOR TO KAISER ENGINEERS, ONE OF THE FINALISTS TOGETHER WITH STERN, ROSERS AND BECHTEL. IT IS OUR UNDERSTANDING THAT THE JOINT KAISER/KEARNEY QUALIFICATIONS AND ECOPE OF WORK STATEMENT AND GENERAL EXPERIENCE ARE REGARDED BY THE EVALUATORS AS SUPERIOR.

KEARNEY MANAGEMENT CONSULTANTS IS A SMALL BUSINESS CONCERN

HEADQUARTERED IN ILLINOIS AND IS VITALLY INTERESTED IN THE OUTCOME OF

cc: Mr. Rhea

THIS PROJECT. AT THE SUGGESTION OF SENATOR PERCY, WE ARE IN DICATING

CREDENTIAL INVOLVEMENT IN THIS PROJECT. WE ARE INTERESTED TO
LEARN IF THERE IS ANY PURTHER PRESENTATION OF QUALIFICATIONS AND
CREDENTIALS WHICH MOULD BE APPROPRIATE. ANY INFORMATION DE
DIRECTION YOU MAY BE ABLE TO PROVIDE WOULD BE GREATLY APPRECIATED.

JAMES M. PHELAN

A T KEARSEY, INC.

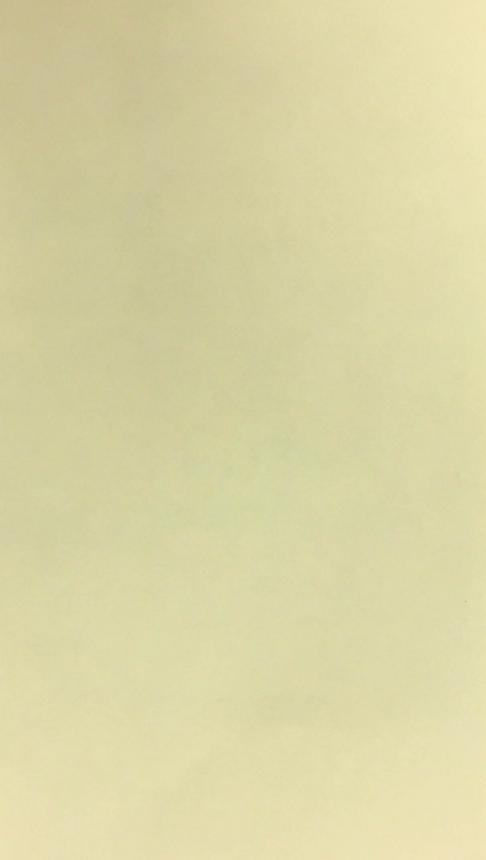
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CHICAGO TULINOTS

RMNY(1257P EDT)

A/E Selection



Capie of Correspondence



WASHINGTON DC 20226

September 14, 1975

Larry F. Roush Commissioner Bullie Bladge Service DSA Washington, D. C. 80245

September 14, 1973, between the General Services Administration and the

Covered by the Memorandum of Understanding and Agreement, transmitted herewith are Department of the Treasu y-Bureau of the Mint approved design Criteria for the project consisting of the following: Proposed Score Architect-Engineer Services, Design and Construction Schedule; Planning Criteria; Design Ga, cities and Materia, Low Charts; Specific Equipment Function Criteria Items 1-36. Tencar Je Mint Layout Drawings; and Coin Data Tables.

It is our intent in the Boreau of the Mint that the Planning Criteria and the Coin Data Tables are not subject to any substantive amendment.

The other documents, however, are proper subjects for review and amendment by all concerned as we proceed through the design and construction of this important new facility.

T trust that the information provided nerewith is sufficient for your requirements. I am pleased that after some delay we are now proceeding with this project and look forward to working with you and your excellent of this important undertaking.

billicerery,

Frank h. MacDonald

Acting Director of the Mint

(as shown)

#### GENERAL SERVICES ADMINISTRATION

Public Buildings Service Washington, DC 20405



7 1973

Mr. Warren F. Brecht
Assistant Secretary for Administration
Department of the Treasury
Washington, DC 20220

war me Appelle!

We are enclosing a "Memorandum of Understanding and Agreement for Design and Construction Services", No. PBS 73-2 and the attachments described therein, for the New Denver Mint, Denver, Colorado, Project No. 05-0061. Please sign and date the Agreement and return the original. A copy as provided for your records.

transferring the amount of \$2,000,000 as partial payment to General Services Administration to provide for all necessary costs in the development of design of the project including the design of the production process. The document transferring the funds should contain a notation that funds are apportioned and available for immediate obligation. In addition, it is requested that the Statutory Reference line in the Memorandum of Understanding be completed by your office.

COUCH oner buildings Service

Enclosures

MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.0

UNITED STATES GOVERNMENT

# Memorandum

TO

: Assistant Secretary Brecht

(Thru Deputy Assistant Secretary Clawson)

DATE: September 12, 1973

FROM

: F. H. MacDonald

Acting Director of the Mint

SUBJECT: Treasury-GSA Agreement Concerning Denver Mint

Attached for your signature is a Memorandum of Understanding and Agreement, together with attachments, concerning the design and construction of the new U. S. Mint at Denver, Colorado. This package, which has been prepared jointly by Treasury and GSA staff, is fully acceptable to the Mint.

As you will note, the total estimated cost of the project is \$55,300,000. So far, Congress has authorized and appropriated a total of \$3.5 million for this project (\$1.5 million for site acquisition and \$2 million for construction). Legislation authorizing the additional funds has passed the Senate and is now pending in the House Public Works Committee.

As soon as you approve the Memorandum, the Bureau of the Mint will prepare the necessary forms for the transfer of \$2 million to GSA as partial payment for all necessary costs in the development of the project. This amount, which has been apportioned by OMB, is available for immediate obligation under the Mint's FY '73 appropriations.

Also attached for your signature is a letter to L. F. Roush, Commissioner of Public Building Services, GSA, transmitting the signed Memorandum.

RECOMMENDATION: That you sign the attached letter to GSA and the Memorandum of Understanding and Agreement.

Attachments





## THE DEPARTMENT OF THE TREASURY WASHINGTON, D.C. 20220

SEP 1 4 1973

Dear Larry:

I am returning to you a signed copy of the "Memorandum of Understanding and Agreement for Design and Construction Services", together with attachments, for the new Denver Mint at Denver, Colorado. The Bureau of the Mint is in the process of preparing the necessary documents for the transfer of \$2 million to the General Services Administration as partial payment for all necessary costs in the development of design of the project.

Sincerely yours,

Warren F. Brecht

Warren

Mr. Larry F. Roush Commissioner Public Buildings Service General Services Administration Washington, D. C. 20405

#### MEMORANDUM OF UNDERSTANDING AND AGREEMENT FOR DESIGN AND CONSTRUCTION SERVICES

PBS No. 73-2 PROJECT NO. 05-0061

AGRICULTU 16-

eres Services Administration and The Department of the Treasury

AN ON A PROJECT

Le War, Colorado

Public Buildings Service Design Management Staff (PCDD) TATUTORY REFERENCES Act of August 20, 1963, P.L.88-102 77 Stat. 129, as amended (31 U.S.C. 291-294); Act of July 9, 1971, P.L. 92-49, 85 Stat. 109; Act of July 13, 1972, P.L. 92-351, 86 Stat. 472

REQUESTED OF GSA

Comes. And Or 100

This project will consist of the design and construction of a New Denver Mint, Denver, Colorado including Production Process Equipment.

For Cons ruction of Pacilities and procurement and installation of Production Process Equipment GSA will advertise, obtain bids, award a daminister contracts using the Construction Manager approach.

The following attachments are hereby made a part of this Memorandum of Understanding and Agreement:

- A. Detailed Estimated Cost, GSA Form 2100A, dated August 23, 1973
- 5. Detailed Agreement, Paragraphs 1 thru 16, dated August 23, 1973
- C. Bureau of the Mint Funding Obligation Planning Schedule, dated August 23, 1973.

PARTICIPATION BY

The Department of the Treasury

it was agreed that General Services Administration would undertake to provide services of the scope described above by using its own facilities and personnel or by contract. GSA will endeavor to provide these account within the limits of costs of the numbered categories indicated on the attached GSA Form 2100A. The Described to of the Treasury agrees to make available to GSA funds sufficient

agrees to make available to GSA funds sufficient whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed, or whenever the scope of the services requested is changed.

on the 14th day of September

, 1973, the parties hereto have executed this agreement.

GENERAL SERVICES ADMINISTRATION

LSSIONER, Public Buildings

THE DEPARTMENT OF TREASURY

Warren F. Breelet

# FOR DESIGN AND CONSTRUCTION SERVICES

- PCGE

8-23-73

PBS No. 73-2 PROJECT NO. 05-0061

NEW Denvey Mint				TOTAL
NEW DENVEY Mint				
and (Price by Trea	1,500,000			
. Appraisal, Title ETC 1	\$1,500,000			
Proliminary PLANNING D	РНА		Taken mes	
and Project ADMINISTRATION CONTRACT-Planning AND	s 1,510,080	205,920		
GSA DEVELOPMENT + los	Equipment Plans AD	448,800	61,200	
GSA DEVElopment + or	312,000	42,000	the seet	
Printing 65A REVIEW	1 000 per t. 00 mm.	15,000	15,000	4 Frederic
1. Survey and subsoil INVE	75,000	45,000		
PRAVEL - GSA PERSUNNEL	15,000	10,000	- Elia	
PRINTING - BIDDING DCCU	15,000	15,000		
. ADVERTISING - CONSTRUCT	5,000	5,000	Strates,	
SUPERVISION	CM - Basic Fee CM-INSP/RES.ENGR	374,200 20,000	629,800 649,000	
OF CONSTRUCTION	Administration	56,020	525,980	
	TOTAL	2,846,100	\$ 2,203,900	\$ 5,050,000
CONSTRUCTION OR IMPROV		just to 4-76)	28,000,000	(4-76)
CONTINGENCIES (On CO	production of the second of the second of the			
Misc. items to be por Landscape Planting.	600,000	30,850,900		
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#### ATTACHMENT B

This Attachment B to the Memorandum of Understanding and Agreement Detween the Department of the Treasury and the General Services Administration is to govern the relationship between the two parties with regard to the design and construction of a new United States Mint at Denver, CO. This Agreement is entered into pursuant to the authority contained in the Act of August 20, 1963, 31 U.S.C. 291.

Whereas, the Bureau desires to construct a New United States Mint at Denver, Colorado, on a site of approximately 38 acres on the west bank of the South Platte River hereinafter referred to as the Project. Now, therefore, the parties mutually agree as follows.

- I. The Bureau of the Mint, Department of the Treasury, hereafter called the Bureau, shall be the agency primarily responsible for fulfilling the terms of the Agreement which are applicable to the Department of the Treasury.
- 2. The Public Buildings Service, General Services Administration, snall be primarily responsible for fulfilling the terms of this Agreement which are applicable to the General Services Administration.
- 3. The Project Budget is estimated to be a total of \$55.3 million, including coinage and other special production equipment and facilities (production process equipment), established as per GSA form 2100A dated August 23, 1973 (Attachment A) and Bureau of Mint Funding Obligation Planning Schedule contained in Attachment C, dated August 23, 1973, which actachments are a part of the Memorandum of Understanding and Agreement. The Bureau will take all steps necessary to obtain Congressional authorization appropriations of the funds required to meet the project budge. in full.
- 4. The Bureau will transfer to GSA, upon execution of this Agreement, the sum of \$2,000,000 as partial payment for all necessary costs in the development of design of the Project including the design of the projection process. The funds may be used for GSA review and management costs, Architect-Engineer costs, and for Construction Manager costs allocable to the design phase. (The Construction Manager functions and costs in the design phase include site work, structure or structures, and production process equipment only as to the equipment's effect on the site and structure, i.e., foundations, footings, mechanical-electrical, gas, water, etc.)
- 5. The Bureau will participate in evaluating the technical proposals received from interested firms under the first step of the Construction Manager selection process. GSA and the Bureau shall jointly determine the level of rating points above which rated firms will be considered for participation in the second step of the selection process.

- Representatives of the Bureau will participate in all contract negotiations between GSA and the Architect-Engineer and the Construction Manager and GSA. The Architect-Engineer and Construction Manager contracts that be executed only after approval of the terms thereof by the Bureau. The Bureau shall promptly review the contracts.
- Tollowing the Sureau's approval of the construction tentatives, the Bureau will transfer to GSA, in accordance with Funding Obligation Planning Schedule, Attachment C, funds as are available from appropriations. This finding will permit starting of phased construction and procurement of recurtion process equipment prior to completion of the design documents. The finds transferred will be available for (a) award of separate construction and production process equipment contracts, (b) GSA management costs in the construction and processing equipment phase, (c) A/E post contract services, and (d) contract to Malager costs for the construction and the processing equipment phases. The Construction Manager costs for the construction phase includes site work, structure of structures, and production process ecuipment only as to the equipment's effect on the structures, i.e., supports, foundations, footings, mechanical-electrical supply coordination of equipment installed with other trades, etc.)
- During the design stage, the Bureau will review all submittals by the Architect-Engineer, or Construction Manager, and will participate in any on-board reviews in the Architect-Engineer's office within the mutually agreed schedule. All Bid Documents, including those for production process equipment, will be advertised for bidding only after approval by the Bureau.
- 9. GSA will utilize its facilities and personnel as may be required for the award and administration of contracts for the design, construction management, construction and procurement and production process equipment of said Project within the Construction Cost Limitation of \$47,850,000 as an April 1976 which includes the total of the separate construction and procurement contracts and contingencies. In the event that the first scheduled contract award is postponed nine months or more beyond the scheduled date of commencement of phased construction as set fort. In paragraph 11 below, this agreement may be modified by mutual agreement.
- The construction cost excludes cost for window drapes, venetian blacks, furniture, movable partitions (except any type of floor to ceiling are not to be considered movable partitions), and all items classified as Group II equipment.
- 11. Subject to the provisions of this Agreement, GSA shall immediately commence performance of the services required hereunder, and shall pursue such work with all diligence to insure that the services to be performed under this Agreement be completed according to the following schedule:
  - a. Commencement of Architectural-Engineering Services Contract

b. Commencement of Construction Manager Contract

November 1, 1973

c. Commencement of Phased Construction

March 1, 1975

d. Completion of Construction and Occupancy by the Department of Treasury

January 1, 1979

#### 12. The Bureau shall:

- a. In conjunction with GSA, make decisions on timely procurement of production process equipment items.
- procurement solicitations for production process equipment, make determinations in accordance with all applicable procurement laws, regulations, judicial proceedings, and Comptroller General decisions as to whether the bias comply with the technical specifications of the solicitations, and provide GSA with documentation. The Bureau's determinations, if in accordance with all legal requirements, shall be accepted by GSA in making decisions on production process equipment contract awards.
- c. In conjunction with GSA, inspect and supervise the installation of production process equipment.
- d. In conjunction with GSA, test, start-up, and make final acceptance inspections on all production process equipment items, systems and sub-systems.
- e. Provide personnel, under the supervision of a full-time bureau Project Manager, to perform the activities and functions listed above.

#### 13. GSA shall:

- a. Furnish monthly Project Summary Reports to the Bureau. These reports will show all funds transferred for the project and total obligations to date.
- b. Furnish the Bureau Project Manager one copy of any and all correspondence pertaining to the Project.
- c. Upon completion of the construction and installation of processing equipment, certify to the Bureau that all work for which GSA is responsible has been completed in accordance with the contract documents.
- d. Furnish the Bureau with three (3) copies of the Final Outline of Architectural Requirements, including a narrative program description, an outline of architectural requirements, functional layout diagrams of the project, and transmit the above copies to the Bureau within 48 hours after receipt from the A/E.

- e. Within 48 hours after receipt from the A/E, transmit to the Bureau 3 copies of Concept Documents, Tentative Documents, and Working Drailings Documents.
- Furnish the Bureau with two rendered pespectives, in color two views, and one model of the total project, suitable for public viewing, within 30 tays after the approval of the Tentatives by the Bureau.
- g. Obtain all clearances and assure compliance with Federal regulations, including Environmental and Civil Defense Standards.
- h. Furnish the Bureau with all deeds, free and clear of legal encumerance and obligations, to the real property included in the Project, and transfer title to the Bureau at the time of occupancy.
- i Make arrangements for ceremonies proposed in connection with the Project, such as groundsteaking, cornerstone taying, and dedication, an coordination with the Bureau, so as to assure adequate preparations therefor and compliance with applicable contractual provisions.
- Paper reproducibles (sepias) of all final working drawings will be given to the Bureau after approval. As-built plastic reproducibles of the working drawings will be prepared by the Construction Manager from marked prints maintained at the job site. The As-built plastics will be given to the Bureau after construction completion.
- Final construction documents presentation material shall have incorporated into the Architect title block, the name J.S. Department of treasury, Bureau of the Mint.
- Whenever the scope of the services requested is changed, or wherever unforeseen circumstances require revisions in the cost estimates, this agreement and attachments hereto will be amended to indicate review and approval by both the Bureau and GSA.

Attachment C

8-23-73

## Bureau of the Mint FUNDING OBLIGATION - By FISCAL YEAR

PLANNING SCHEDULE - NAW DISTVER A. LA

	973	1974	1975	1976	1977	FY 1978	DOLLARS IN MILLIONS
SITE							2 50
Acquisition	1.50		0.50		2:03	55 25	1.50 2.50
Development Work			2.50				2.50
Exterior Lighting, Landscaping & Miscellaneous					0.60		0.60
DESIGN SERVICES							
Production Process Design		0.30					0.30
Site Development Drawings		0.14				- 85	0.14
Facility Building Design		0.86	0.55			1 2 3	1.41
Equipment Spees, and Survey						1 22	0
Equipment Potential		80.0					0.08
Equipment Procurements, • Installation Drawings			0.30		•		. 0.30
BUILDING (S)						1 15	
Construction Cost				26.90		. 4 8 8	26.90
				20.50		2 65	20.90
EQUIPMENT		1				1 44	
Equipment Cost			8.70		6.00	8 24	14.70
Equipment Installation Cost					3.15	E 22	3.15
CONSTRUCTION MANAGEMENT						8 25	
Design Review, Project						0 85	
Programming and						B 18	
Scheduling		0.62	,			7 1	0.62
Construction Supervision			1.70			4 2	1.70
Equipment Inst. Supervision					0.50		0.50
Staft-up, relocation and transition						0.90	0.90
No files television and the contract decoupes the contract of a decoupe of the contract of the				l			
funding requirements	1.50	2.00	13.75	26.90	10.25	0.90	55-30

Frank Rhea

August 25, 1972

SPR

Acquisition of Now Denvor Mint Site

Assistant Commissioner for Space Management - PR

Enclosed is the final draft of our first letter to the Mayor of Denver to initiate an agreement regarding the Mint site.

We will appreciate your concurrence and/or suggestions at your earliest opportunity.

GRECORY CAVAMAGE
Pegional Director
Public Buildings Service

Enclosure

Reading - SP Index - SPR File - SPRA Chron - SPR

8PR/ILLuikens/gm 8/25/72 X4358

Transmitted 8/15 to Wash. (Laura) FINAL DRAFT August 25, 1972

Honorable W. H. McNichols, Jr. Mayor of Denver Denver, Colorado 80202

Dear Mayor McNichols:

Officials of the Department of the Treesury have advised that the South

Platte River Site has tentatively been selected as the location for the

new Denver Mint subject to the satisfactory resolution of various factors,

the majority of which are set forth herein.

In order to utilize this site, it will be necessary to acquire the approximate 33 acres outlined on the attached plat. Based upon our preliminary investigations, it appears that the site is comprised of approximately 13 acres owned by the City of Denver and approximately 20 acres of privately-owned property with 35 separate ownerships. In addition, portions of 7th, 8th, 9th and 10th Streets would have to be vacated, Water Street rerouted, and utility lines and sewers relocated.

Of particular concern is the necessity to obtain the maximum site width possible in the vicinity of the 23rd Avenue bridge. Also, the proposed Market Street Throughway would need to be realigned so that the required right-of-way would not project north of West 19th Avenue extended. Further, we understand that a 72-inch interceptor sever is proposed to be located in the approximate center and running the entire length of the site parallel to the Platte River. This location would be incompatible with the construction of the large building required for the new Mint.

It is understood that there has been an informal agreement made whereby the City of Denver will assemble the entire site of approximately 33 acres

and convey the property to the United States Government at a cost not to exceed the \$1.5 million available for site acquisition. Accordingly, the action by the City will include the acquisition of the privately-owned parcels needed, relocation of the streets and utility facilities, and the paying of all benefits to persons and businesses as required by the Uniform Relocation Assistance and Real Property Acquisition Pelicies Act of 1970.

In furtherance of this plan, it is now necessary that the formal approval of the City be secured. The approval should be legally sufficient to permit the City of Denver and the United States Government to enter into a binding agreement covering all facets of the requirements and obligations of both parties. The formal approval should contain provisions that would enable the City to acquire the necessary property and expend all other necessary funds in connection with the obligations created. The requested approval by the City of this plan is needed so that we may proceed with a draft agreement and further planning in the selection of the proposed site.

The Department of the Treasury has informed us that a site must be available for construction purposes by April 1, 1974; therefore, it is felt that initial endorsements and approvals of the formal agreement should be completed by January 1, 1973. To this end, may we expect your reply within the next 30-day period.

To insure there is a full agreement by all parties as to the exect size of parcel to be conveyed to the Federal Government, it is requested you

furnish this office a plat of the subject area with complete legal description and any easements at the earliest possible date.

Please do not hesitate to call upon us for further discussion and detailed information. We will be glad to meet with you and your representatives to assist in expediting this phase of the project development and will look forward to participating in this development of the Platte River Site for the new Denver Mint.

Sincerely,

JOSEPH L. COHEN Acting Regional Administrator

- Enclosure - PLAT OF SITE

Mr. John J. Stamm, P. E.

Director of Design Engineering
City and County of Denver
City and County Building
Denver, Colorado 80202

RE: U. S. Mint Agreement

Dear Mr. Stamm:

This is in response to your letter of May 2 addressed to Mr. Rhea of the Bureau of the Mint regarding utility requirements and other matters pertaining to the site agreement between the City of Denver and the United States Government.

Enclosed are copies of GSA Form 1714, "Equal Opportunity Clause".

Also enclosed is one set of prints which have been annotated to show details of what utilities will have to be removed from the site, the locations for on-site termination of utilities for the new Mint, and a corridor wherein it would be agreeable for utilities requiring relocation to cross the site.

Regarding your question as to what utilities will have to be placed underground, it is our desire that there be no aboveground utility lines in the area between Highway I-25 and the South Platte River and between the I-25 crossing of the South Platte River and Speer Boulevard. This relates also to your question pertaining to the power line matter on Page 7(e) of the Draft agreement. The existing 115 KV line on steel towers on the southern portion of the site must be relocated offsite. We are not attempting to dictate the specifics of this relocation, but if this line is relocated to the immediate right bank of the South Platte River, we would prefer that it be underground so that

eastward toward the center of Denver. We realize, of course, that the rail yards must be relocated and the area redeveloped into a park, or something similar, before we will have real improvement in site aesthetics. Perhaps this 115 KV line could remain aboveground until such time as the railroad relocation is accomplished. At any rate, the electric power service into our on-site substation will need to be placed underground.

As to your question regarding the required size of all utilities, we have computed the figures listed below. These requirements are subject to some change as we proceed with detailed design of the facility, but we have calculated these requirements based on our detailed process layouts and extrapolating from Philadelphia Mint useage and, therefore, believe the figures are accurate within plus or minus ten percent. We are planning the new Mint for an initial 1980 production requirement, plus making provisions for 100 percent production expansion. Thus, although our initial useage will be about one-half of ultimate useage, we feel it is prudent to size all lines and feeders to meet the ultimate requirements. Our calculated utilities requirements are as follows:

#### STEAM

It is our hope that we can connect to the Zuni Plant of Public Service Company to obtain steam for heat and air conditioning of the buildings. If this can be resolved with the Public Service Company, our average requirement during the heating season would be 30,000 lbs. per hour at about 140 psig. Our maximum requirement in the coldest weather periods

would be roughly twice this average. If it is not possible to connect to the Zuni Plant for building heating requirements, we would need an addition to the gas requirements stated below to provide for this heating.

#### ELECTRICITY

Our initial requirement is for a connected load of 35,000 KVA and the ultimate requirement for 50,000 KVA. Our average useage would be about 75 percent of both of these figures.

#### GAS

Our initial requirement is for 46,000 cu. ft. per hour at about 4½"

water column and our ultimate requirement is for 75,000 cu. ft. per

hour. This is what we would like to have from the Public Service Company. We realize there are problems with gas supply and distribution and are prepared to discuss this matter in more detail with the Public detailed Service Company during our/design.

#### WATER

Our initial average requirement is for 300 gallons per minute and the ultimate is for an average of 600 gpm. Our peak ultimate would be about 900 gpm. These are for operational use only and should be increased to provide fire protection for buildings approximating 700,000 sq. ft.

#### SEWAGE

For planning purposes at this time, the operational water consumption figures are considered appropriate for determining sewage discharge.

#### TELEPHONES

Our requirement will be (both initial and ultimate) for approximately

We do not know of any special protective covering for any of the underground utilities other than those normally required in the area to provide for protection against water damage and corrosion. There will be extensive vehicular traffic plus railroad siding crossing over some of these utility lines. In our design and construction, we will provide for bridging of these utilities to prevent any damage from surface loads.

Another matter that we want to make clear, which is not covered in the present Draft agreement, is that we will need access to the site for employee automobiles and truck/trailers from the south end of the site. This means that the design of the new Market-Blake Parkway needs to be such that we will have a minimum of 14' vertical clearance and a minimum of 24' width between supports for this parkway.

The easements for the interceptor sewer are satisfactory, except for the note we have made on Schedule "D".

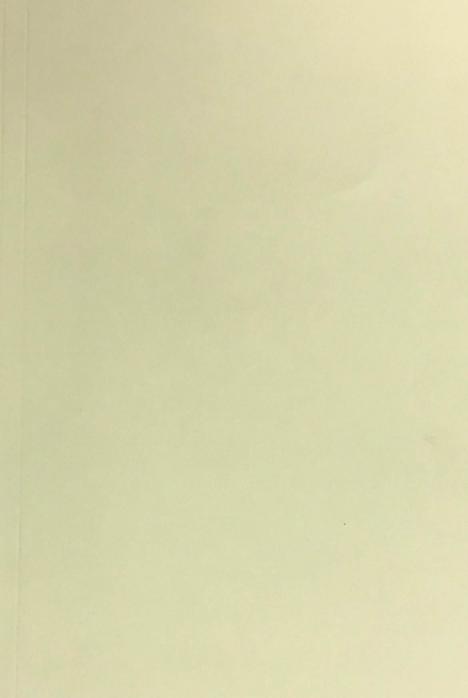
I trust the above provides answers to all of the matters in your letter of May 2, and that we may proceed expeditiously to an execution of the site agreement between the City and the Government.

Very truly yours,

MICHAEL J. NORTON Regional Administrator Capie of Correspondence



anhardograd Survey File Correspondence



## UNITED STATES OF AMERICA GENERAL SERVICES ADMINISTRATION

Region 8

Denver Federal Center

Denver, Colorado 80225 Project No. N-CO-72-600

New Denver Mint

Archaeological Survey



Mr. Frank Rhea Facilities Project Manager 320 West Colfax Avenue Denver, Colorado 80204

AUG 8 1974

Dear Frank,

August 7, 1974

OFFICE OF SUPERINTENDENT U. S. MINT AT DENVER

As requested in your letter of July 16, 1974, we have had an on-the-ground archaeological survey of the northwest corner of the Park Hill Golf Course Site which has been selected as the site for the new Denver Mint. The report indicates that locating the new Mint on this site will not affect anything of archaeological value. However, any findings of potential archaeological interest during the construction stage will be reported to the State Historical Society of Colorado, as requested by their report of August 2, 1974, (copy attached for your information.)

In a telephone conversation of August 6, 1974 Linda Williams, Staff Archaeologist making this report, confirmed that the reference to artificial landfill on this site was only the superficial surface grade changes as required to develop the golf course and did not indicate any major landfill operations previously at the site.

This report confirmed our previous belief that archaeological material would not likely be encountered at the Park Hill Golf Course Site; however, by completing this survey we believe we have made full compliance with Public Law 93-291. The cost of this survey was \$62.31. We trust this meets with your approval.

Sincerely,

DAVID L. GESS

Project Director New Denver Mint

Attachment

## THE STATE HISTORICAL SOCIETY OF COLORADO

State Archaeologist, 5A Ketchum Bldg., University of Colorado, Boulder 80302

August 2, 1974

Mr. David L. Gess Project Director New Denver Mint General Services Administration Denver Federal Center Denver, Colorado 80225

Dear Mr. Gess,

An on-the-ground archaeological inventory was conducted today at the Park Hill Golf Course Site for the New Denver Mint. Two investigators from the Office of the State Archaeologist surveyed the area in question and concluded that the proposed site for the New Denver Mint will not affect anything of archaeological value. Most of the golf course is artifical landfill; however, if in the course of construction you should find anything in or below the land-fill, the Office of the State Archaeologist should be contacted for an assessment of archaeological importance.

Sincerely,

Linda Ward Williams Staff Archaeologist

### THE STATE HISTORICAL SOCIETY OF COLORADO

 $State\ Archaeologist, 5A\ Ketchum\ Bldg., University\ of\ Colorado, Boulder\ 80302$ 

#### EXPENSES INCURRED IN THE NEW DENVER MINT ARCHAEOLOGICAL INVENTORY

Consultation fee	50.00
Travel @.15 per mile	9.15
Meals	3.16
TOTAL DUE	62.31

A receipt will be sent your office upon the arrival of the check.

50



#### THE DEPARTMENT OF THE TREASURY

UNITED STATES MINT DENVER, CoLo. 80204 July 16, 1974

Mr. David Gess
Project Engineer,
Construction Management Division
Public BuildingsService
Region VIII
Denver Federal Center, Building 41
Denver, Colorado 80225

Dear Dave:

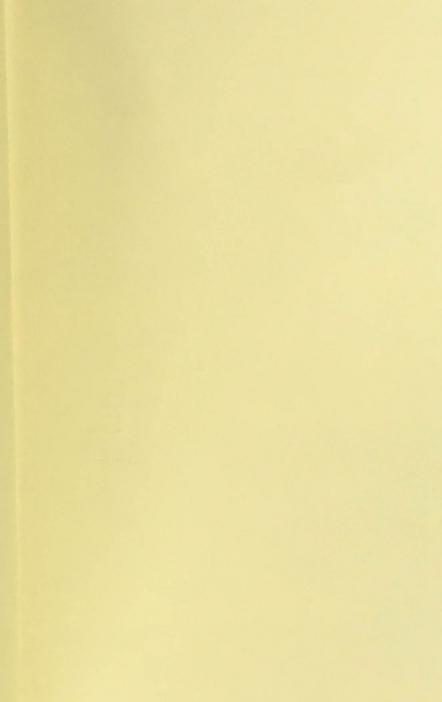
Attached is a letter from the Office of the State Archaeologist pertaining to an archaeological survey of the proposed mint sites. It is requested that you contact Mr. Hester (telephone 449-0630) to arrange for an archaeological survey for the Park Hill site only, as discussed in Mr. Hester's letter, using funds which have been transferred to your agency for the new Denver Mint project.

Sincerely,

Frank W. Rhea Facilities Project Manager

Attachment

anhaenlogical Survey File Cordinamence



assey amior Correspondence



OPTIONAL FORM NO. 10 JULY 1973 EDITION GSA FPMR (41 CFR) 101-11.6

#### UNITED STATES GOVERNMENT

## Memorandum

TO : Those Listed \*

DATE: May 14, 1976

FROM : Mrs. Betty Higby, Superintendent, Denver Mint 949

SUBJECT: Revised Standard Working Drawings

Enclosed are revised vellums and a print of each of the following drawings:

C-16-01, Chg. A C-16-10, Chg. C C-16-02, Chg. A C-16-11, Chg. B C-16-03, Chg. A C-16-13, Chg. A C-16-07, Chg. C C-16-19, Chg. A C-16-08, Chg. B

These are the changes as approved at the last Standardization Meeting, and are not the drawings to use. All of those prints and vellums in your possession that are not revised should be destroyed.

#### Enclosures

\*cc:

S. Bobbie (Pa.)

G. Dawson (Wash.)

H. Edwards (N.Y.)

Dr. Goldman (Wash.)

T. Miller (S.F.)

Supt.
Deputy Supt.
Assay

B & M



OPTIONAL FORM NO. 10 JULY 1973 EDITION GSA FPMR (41 CFR) 101-11.6

TO

#### UNITED STATES GOVERNMENT

## Memorandum

Frank H. MacDonald, Acting Director of the Mint

Attention Dr. Alan J. Goldman, Asst. Director DATE: May 5, 1976

FROM : Mrs. Betty Higby, Superintendent, Denver Mint

BASIS

SUBJECT: Proposed Standardization Finger Changes

At our last Standardization Committee Meeting, it was decided that Denver, San Francisco, and Philadelphia would each send to Dr. Goldman their proposed additions or subtractions to the standard finger drawings.

Under separate cover, we are sending marked-up prints of Drawings No. C1-16-18 (1 sheet), and No. C1-16-22 (4 sheets). We have marked on these prints our suggestions as to the best way to make revisions. Please review these with Galen Dawson, and with the prints from Philadelphia and San Francisco, and if these prints meet with your approval, please return them to us so that we can make the changes on the standard drawings.

There may be some arguments about this, but this is what Denver wants to do, and we believe that the changes, as indicated, would be to the best advantage of all concerned. You should check these out with Galen Dawson.

cc: Galen Dawson

Separate cover:

Denver Dwg. No. C1-16-18(1 sheet) Denver Dwg. No. C1-16-22(4 sheets)



assay amior Correspondence



Dochgrand Information

OPTIONAL FORM NO. 10
MAY 1912 EDITION
GRAF FMR (41 CFR) 101-11.0
UNITED STATES GOVERNMENT

### Memorandum

TO : Frank W. Rhea, Facilities Project Manager

DATE: October 16, 1972

FROM :

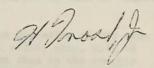
H. Frost, Assayer

SUBJECT:

I got tired of waiting around, so this morning I went to the Planning Office to see if I could unearth any underground information as to what had transpired. I was not able to talk to Mr. Canter but to his assistant, Bob Damerau. He gave me the following information:

- 1. The project, as a whole, is proceeding satisfactorily as far as willingness to cooperate with the Treasury. However, the financing of the operation is still a problem, above and beyond the Planning Department.
- 2. The Market-Blake Streets throughway is now planned to cross to the west at about Seventeenth Street. It will be an elevated structure and interlace with the present Highway 25 bridge across the river. This is about where the highway to Bears Stadium turns off of I-25. This was our original guess at the location. The RTD has received the grant from the Government for 11 million dollars to complete a "people mover" line from the stadium area to downtown Denver. This is to be done in conjunction with the Blake-Market throughway. I saw the preliminary Transportation Department drawings, but they are not for publication. This is good or bad news, however you look at it.
- 3. Black and Veech have done some preliminary planning for the 72" sewer line. They say, off the record, that it can be moved over to the present 54" line; the difference being the increased cost which no one has volunteered to pay.

Hope you are getting along well with your San Francisco troubles. Please let us know if you want us to start revisions on the environmental statement.





· Proj. 131.

Mr. Paul McDonald Director, Office of Administrative Services

May 22, 1970

Mrs. Mary Brooks Director of the Mint(Signed) Mary Brooks DISCEQ WIEPA

Environmental Statement
Future New U. S. Mint - Denver, Colorado

#### A. Probable Impact New Mint May Have on Environment

Any facility conducting such operations as will be conducted in the new Mint will generate materials, the external dispersion of which may adversely affect the atmosphere and hydrological environment. It is intended to adequately control potential contaminants so as to preclude any adverse effect.

Long range plans provide for the acquisition and ultimate use of some 30 acres of land area, affording room for expansion as well as the inclusion of ancillary equipment required to treat plant effluents for rigid control of potential contaminants.

#### B. Probable Adverse Effects Which Cannot Be Avoided

No known adverse effects will result from the construction and operation of the new Mint. Operations from which pollutants may result and the method of controlling same are outlined as follows:

#### (1) Water Pollution

Waste water, with several degrees and types of contamination, may be generated in the new facility.

Acid waste from Assay Laboratory operations will be generated, but will be passed over a bed of neutralizing media, such as limestone, before discharging into the sewer system.

Process cooling water necessary for the operation of air compressors, furnaces, casting equipment, roll mills, etc., will be filtered for removal of solids. Temperature rise in the process cooling water will necessitate the use of cooling towers and heat exchangers for temperature reduction. Recycling will enable reuse of water thus effecting conservation. Small amounts will be diverted to the sewer system but should contain no contaminants and should not be of higher temperatures.

Water soluble oils, used for cooling rolls in the reduction mills, will be recycled and reused. The oil will subsequently become unusable and will be diverted to storage tank for removal by tank truck for final disposal.

Condensate from the steam system will not be run to the sewer system, but will be diverted to process cooling water or returned to the steam generation plant for use as makeup water.

The blank cleaning, and strip-bonding, cleaning line requires the use of cleaning solutions, detergents, and abrasives which are used in conjunction with water. This waste will be diverted to a settling basin for neutralization and solids removal before being diverted to the sewer system.

#### (2) Air Pollution

Mint processes require the melting and casting of various metals and metal alloys in the manufacture of coins. Also, incineration of certain waste materials is necessary for disposal. Metallurgical gases, fumes, and smoke generated from the above processes will be passed through a scrubber (mixing tank for the gases and water supply), then run to a settling basin wherein the solids precipitate out and are removed. Scrubber water will be recirculated for reuse with about 10 per cent makeup required. Water within the system may be periodically dumped into the sewer system when settling tanks are cleared, or it may be disposed of by trucking from the facility for disposal.

Fumes and exhaust from laboratory hoods in the Assay Offices will be evaluated and if the concentration of contaminants is negligible, they will be exhausted direct to the atmosphere. Should it be necessary, the exhaust will be passed through a filter madia for neutralization.

Air exhausted to the outside atmosphere direct from equipment will be run through filters or adsorption media to remove solid particles and excessive amounts of moisture as may be necessary.

Need for filtering air being exhausted from general work areas to the atmosphere is not forseen.

#### C. Alternates to Proposed Action

The new Mint facility will, of course, necessitate the expenditure of resources, i.e. water, natural gas, electrical service, and those

basic resources utilized in the construction and equipping of the plant. Offsetting this, in part, will be those resources conserved by curtailing operations in the old Denver Mint.

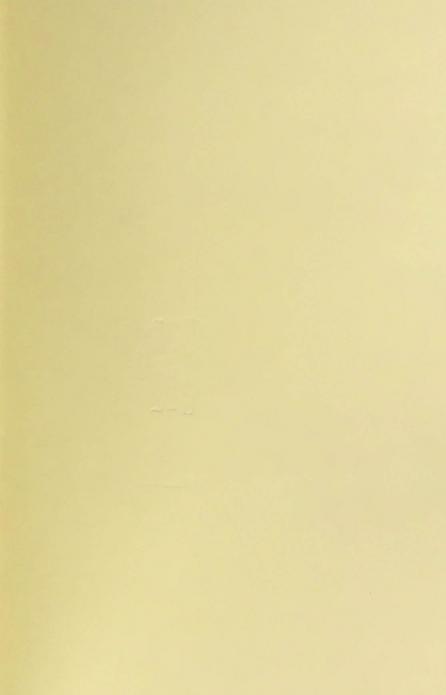
Utilization of a land area heretofore uncommitted to industrial application is planned. In exchange for this utilization, ultimately the present Mint site may be programmed for use in expanding county!

No alternates to the construction of a new Mint are offered. Projected demand for coins dictates that a new facility be provided since required production cannot be accomplished in existing Mint institutions.

#### D. Irreversable or Irretrievable Commitments of Resources

Construction of the new Mint in Denver is not expected to commit resources to the point of being irreversable or irretrievable. Should, for some reason, the facility be ultimately closed and physically removed, return of all natural resources to previous conditions could be effected.

Dorhquand Information



Bicentennial Con Storage



# The Department of the TREASURY

BUREAU OF THE MINT WASH, BC 2020 - MACHINE



Hold for Release 11:00 a.m. FDT, Wadnesday, August 20, 1975

August 19, 1975

### SPECIAL ORIENDIC PROGRAM FOR SPECIAL BICENTENNIAL COINS

In a break with its traditional ordaring procedures for special coins, the U. S. Mint is taking the unusual step of offering 40% silver Bicentennial coins under a new Bulk Rate Program, Mrs. Mary Brooks, Director of the Mint, armounced today.

The new Bulk Rate Program is offered in combination with the Mint's long standing custom of accepting only mail orders for limited quantities of special coins and it applies only to the three-piece 40% silver Bioentermial uncirculated sets.

The program has been designed to comply with the wishes of Congress to make these historic coins available to the greatest number of people possible.

Under Public Law 93-127, Congress authorized a new coinage design and date emblematic of the Bicentennial of the American Revolution for dollars, half dollars and quarters. They also mendated the mintage of at least 45 million silver specimens of these coins to assure their wide availability to the public.

To encourage public participation in the national coinage tribute to the Bicentennial, the Treasury Department sponsored a national competition for the new designs. As a result of this competition a colonial drummer, Independence Hall and the Liberty Bell and moon were selected to appear on the reverses of 1776-1976 dated Washington quarters, Kennedy half dollars and Eisenhower dollars, respectively.

The bulk rate, open to all persons, permits the purchase of lots of 50 Bicentermial silver uncirculated sets at \$7.00 per set. The sets sell for \$9.00 each when ordered by mail from the Mint in lesser quantities. The lower price represents a \$2.00 per set savings in order processing, packaging, postage and registry fees.

The Bulk Name Program for the 40% silver Bicentermial uncirculated sets goes into effect on September 1, 1975. Interested individuals, companies or organizations may make certified checks or money orders for lots of 50 sets or more payable to the Bureau of the Mint, and mail the orders to:

Bulk Pate Bicentennial Coin Program Post Office Box 5500 San Prancisco, California 94101 After receipt of an order, it is expected that it will take 2 to 3 weeks to process the order and send the sets by registered mail. Each 50-unit package will contain two 8-3/4" x 8-3/4" color illustrated counter top posters and customer information about the Bicenternial coins.

A great number of financial institutions have already expressed an interest in selling these historic coins over the counter to their customers. The Mint anticipates that numerous others will also want to make these quality numerous of our Nation's 200th birthday available to friends and customers.

The new Bioenternial circulating cupro-mickel coins will tourn the hands of every men, woman and child in America. And the Mint also hopes that the special silver specimens will become treasured family keepsakes of a momentous occasion in our national life.

# The Department of the TREASURY

BUREAU OF THE MINT

WASH., D.C. 20220 - W04-5011



FOR IMMEDIATE RELEASE

BICENTENNIAL CIRCULATING COINS ARRIVE

JUL 3 1975

July 1, 1975

OFFICE OF SUPERINTENDENT

Bruce K. MacLaury, President of the Federal Reserve Bark of MINT AT DENVER Minneapolis, has invited Mint Director Mary Brooks to that city to launch the national coinage salute to the Bicentennial on Monday, July 7, 1975.

Minneapolis is the hometown of Mr. Seth G. Huntington, designer of the reverse of the first Bicentennial coin — the half dollar — to go into circulation.

A public ceremony is planned at 11:15 a.m., July 7, on the Plaza of the Federal Reserve Bank of Minneapolis, 250 Marquette Avenue, Minneapolis, Minnesota. Mr. Huntington, Mr. Jack L. Ahr of Arlington Heights, Illinois, designer of the Bicentennial quarter reverse, Mr. Dennis R. Williams, sculpture student at the Columbus (Ohio) College of Art and Design and designer of the dollar reverse, and Federal and Minnesota State officials have been invited to participate in the outdoor coinage celebration of our nation's 200th birthday.

Public Law 93-127 authorized release of three newly designed coins emblematic of the Bicentennial of the American Revolution beginning July 4, 1975. On July 7, commercial banks throughout the nation will begin receiving the Bicentennial circulating half dollar. Shortly thereafter, the circulating quarter will be released, followed by the dollar well before the end of the year. Commercial banks may order the three Bicentennial cupro-nickel circulating coins through the Federal Reserve Bank, or correspondent bank, that serves their coin needs.

The Mint expects to produce at least 300 million dollars, 550 million half dollars and 1.6 billion quarters for circulating between now and the close of the Bicentennial year.

The three new Bicentennial designs were chosen in a national \$5,000 award competition sponsored by the Department of the Treasury. A colonial drummer was selected for the quarter reverse, Independence Hall for the reverse of the half dollar and a combination Liberty Bell and moon for the back of the dollar.

The obverses of the quarter, half dollar and dollar will carry the double date 1776-1976 under the portraits of Presidents Washington, Kennedy and Eisenhower which remain, respectively, on the three coins.

Forty percent silver proof and uncirculated specimens of the Bicentennial coins are also available by mail order from the Bureau of the Mint, 55 Mint Street, San Francisco, California 94175. The three-piece silver Bicentennial proof sets are \$12 per set. The silver uncirculated sets are \$9 each.

"The Bicentennial coins represent the most important coinage change in the Mint's history," Mrs. Brooks said. "It is the first time designs on circulating coins have been changed in honor of an anniversary of American Independence and I expect them to touch the hands of every man, woman and child in the country."

#### FACT SHEET ON BICENTENNIAL COINS

#### What are the Bicentennial coins?

In honor of our Nation's Bicentennial the designs on the reverse sides (backs) of the dollar, half dollar and quarter are being changed. In addition, each coin bears the double date "1776-1976". This change was authorized by Congress in the Act of October 18, 1973.

#### What do the new designs look like?

The <u>dollar</u> reverse shows the Liberty Bell and the moon. The reverse of the <u>half</u> <u>dollar</u> depicts Independence Hall. The back of the <u>quarter</u> pictures a Colonial drummer. The designs were chosen from those submitted in a national competition.

#### Are the obverse sides (front) the same as they were?

Yes, except for the change in date to "1776-1976", the obverse or "heads" sides have remained the same. Presidents Eisenhower, Kennedy and Washington continue to be honored on the dollar, half dollar and quarter, respectively.

#### How and when can I get some of these new coins?

Bicentennial half dollars are to be released beginning July 7, 1975. These are to be followed by the quarters and dollars later in the year. The coins are being issued to the public only through commercial banks.

#### How long will these new coins be available?

The coins will be released by the Federal Reserve to commercial banks constantly throughout the Bicentennial period, at least through 1976. After that time, the coins must again bear the date of coinage. The coins may continue to bear the Bicentennial designs at the discretion of the Secretary of the Treasury.

#### Are they different in any other way from regular coins?

The coins are the same size, shape, weight and metallic composition as the 1974 coins.

#### Can I get the 1975-dated dollars, half dollars and quarters?

No 1975-dated dollars, half dollars or quarters will be produced by the Mint.

#### What can you tell me about the special silver sets of these Bicentennial coins?

The special sets of these three coins are available in 40% silver in "proof" (\$12.00) and "uncirculated" (\$9.00) quality. Each set contains one each of the three coins, hand-somely packaged. For more information, customers may write:

Bureau of the Mint 55 Mint Street San Francisco, CA 96175

#### Where can I get more information about the new Bicentennial coins for circulation?

All inquiries should be addressed to:

Department of the Treasury Bureau of the Mint Office of Public Services Washington, DC 20220

Telephone Number: (202) 964-5011 or (202) 964-2389

OPTIONAL FORM NO. 10 MAY 1962 EDITION GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

## Memorandum

TO : Employees, United States Mint at Denver

Facilities Project Myr.

DATE: June 13, 1975

FROM : Superintendent

SUBJECT: Information re Bicentennial Coins

The attached information, received on telecopier today, is for your information and for dissemination to the public. The letter and attachment were mailed by the Bureau of the Mint to national banks to avail tellers of information asked of them. Primarily, the Bureau is requesting we tell interested parties that the half dollar will be released on July 7, 1975, and the release of the quarter and dollar will be later in the year (a definite date has not yet been set).





WASHINGTON, D.C. 20220

OFFICE OF DIRECTOR OF THE MINT

June 9, 1975

Dear Sir:

Do you know about the big change in your small change?

If not, you soon will - because those famous faces of Risenhower, Kennedy and Washington now have a new date - 1775-1976 - and new backs in celebration of our Nation's 200th birthday.

On July 7, or soon after, you will receive the first of the Bicentenniel coins the half dollar - to release to the public. And before the end of the year, the Federal Reserve System will have distributed ample supplies of all three circulating coins to the Nation's financial institutions.

Then, when you flip a quarter and it comes up tails, you are going to see a Colonial drummer; Independence Hall will great you on the half dollar; the moon and Liberty Rell on the dollar. The three new reverse designs chosen to appear on these historic coins were selected in a national design competition that drew close to 1,000 entries.

Initially, there may be a run on the coins by collectors and the general public. Rest assured, however, that sufficient quantities of 1974 quarters, halves and dollars are on hand to meet any emergency, and production of the Bicentennial coins has been increased in anticipation of unusual desend.

To me, these coins - like all our coins - are symbols of our Mation's 200 years of freedom. They are small pieces of our bistorical and cultural beritage - passing from hand-to-hand and linking us to the cherished ideals of our forefathers. LIBERTY was the rallying cry of the American Revolution - and LIEERTY has been so proclaimed and inscribed on each and every coin since the creation of the U.S. Mint in 1792.

lammehing a national coinage was a big step forward in the formation of our young Bation. We are now launching the most significant coinsge change in the history of the Mint.

I believe this revolutionary design change honoring an anniversary of American independence will let the public know the Spirit of '76 is alive and well at their friendly neighborhood bank. I hope when you see these coins they will inspire you to give then the warm, innovative introduction to the public they deserve.

Attached is an information sheet you may wish to duplicate and give to your tellers. It should be helpful in enswering questions they most likely will be asked by your customers.

Thank you for whatever you can do to help make our Bicentennial a noteworthy celebration.

Director of the Mint

Keep Freedom in Year Future With U.S. Savings Bonds Rec'd un telecopier. 6-13-75, @ 1:10 pm

Your customers may be asking you .....

#### What are the Ricesternial coins?

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#### What do the new designs look like?

The <u>dollar</u> reverse shows the Liberty Bell and the moon. The reverse of the <u>half</u> <u>dollar</u> depicts Independence Hall. The back of the <u>quarter</u> pictures a Colonial drusser. The designs were chosen from those submitted in a national competition.

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#### How and when can I get some of these new coins?

Bicentennial half dollars are to be released beginning July 7, 1975. These are to be followed by the quarters and dollars later in the year. The coins are being issued to the public only through commercial banks.

#### How long will these new coins be available?

The coins will be released by the Federal Reserve to commercial banks constantly throughout the Ricentennial period, at least through 1976. After that time, the coins must again bear the date of coinage. The coins may continue to bear the Bicentennial designs at the discretion of the Secretary of the Treasury.

#### are they different in any other way from regular coins?

The coins are the asse size, shape, weight and metallic composition as the 1974 coins.

#### Cam I get 1975-dated dollars, half dollars and quarters!

No 1975-dated dollars, half dollars or quarters will be produced by the Mint.

#### What can you tell me about the special silver sets of these Bicentennial coins?

The special sets of these three coins are available in 45% silver in "proof" (\$12.00) and "uncirculated" (\$9.00) quality. Each set contains one each of the three coins, hand-tomely packaged. For more information, customers may write:

Bureau of the Mint 55 Mint Street San Francisco, CA 96175

#### Where can I get more information about the new Ricentennial coins for circulation?

#### All inquiries should be addressed to:

Department of the Treasury Bureau of the Mint Office of Public Services Washington, DC 20220

Telephone Rumber: (202) 964-5011

er (202) 964-2389

June 1975

On March 6, 1974, the Secretary of the Treasury and Director of the Mint made the final selections of the three winning designs resulting from the National Bicentennial Coin Design Competition for the reverses of the dollar, half dollar and quarter. The Treasury Department awarded \$5,000 to each of the winning designers.

JACK L. AHR, 1802 South Highland Avenue, Arlington Heights, Illinois 60005, designed the colonial drummer boy selected to appear on the reverse of the quarter.

Mr. Ahr opened his own company, Jack Ahr Design and Sales in Arlington Heights, two years ago. The company specializes in the design of custom products, such as sales and employee incentives awards. For 16 years prior to opening his own business, he was employed as an artist, art director and director of creative services for companies serving the high school, college and industrial markets, designing such items as class rings, medals, pins, special awards and commemorative medallions.

He studied art for two years at the Bowling Green State University, Bowling Green, Ohio, and continued his art studies at the John Herron Institute of Art, Indianapolis, Indiana and the American Academy of Art, Chicago, Illinois.

Mr. Ahr served two years in the U. S. Army stationed at Fort Knox, Kentucky. Born June 23, 1931, at Cincinnati, Ohio, he is married and the father of five children.

SETH G. HUNTINGTON'S design of Independence Hall was selected to appear on the reverse of the half dollar. Mr. Huntington resides at 4153 Aldrich Avenue South, Minneapolis, Minnesota 55409.

Currently he is manager and art director of the Custom Art Department of Brown and Bigelow, the largest calendar and advertising specialty house in the world. He is a graduate of Minneapolis College of Art and Design and served on the faculty of the St. Paul Arts and Science Center.

His experience as an artist and designer has been in corporate design, educational materials, book illustrations and advertising and display. He has received numerous citations and awards including two "Printing Industries of America" annual graphic arts awards. He has exhibited as a potter and sculptor and specializes in small highly detailed pieces sculpt in wax and cast in sterling through the lost wax process.

Born February 12, 1930, in Minneapolis, Minnesota, he is married, the father of eight children and he has two grandchildren.

DENNIS R. WILLIAMS, whose design of the Liberty Bell and moon has been chosen for the back of the dollar coin, is a student.

He is 21 years old and in his junior year at the Columbus College of Art and Design in Columbus, Ohio, majoring in sculpture. His sculpture instructor assigned him the National Bicentennial Coin Design Competition as a design problem.

Mr. Williams was born in Erie, Pennsylvania, October 26, 1952, but resides at 880 East Broad Street in Columbus while attending school. He says he would eventually like to teach sculpture at the college level and plans to use his \$5,000 award to continue his education.

C. C. Ambrose Initialed

Additional Storage for Bicentennial Coins - Denver Mint

Per your note, F. W. Rhea's analysis on above subject forwarded to you by memorandum dated July 11 is commented upon as follows:

In our past discussions and in a more recent discussion with F. Rhea on the above subject, it was our line of thought that cent coins (and maybe nickels) should be stored outside the Mint structure and make such vacated space available for storing subsidiary coins. The three-weak Denver cent production, 250,000,000 pieces, was thus established as the storage requirement exterior to Mint.

Over the past 12 months, the average inventory in cents has been 55,000,000 pieces (11,000 bags) and the inventory in nickels, 27,000,000 pieces (6,750 bags). With a total current storage capacity of 100,000 bags in the Denver Mint vaults, cents and nickels, with a total average inventory of 17,750 bags, have occupied 18% of this storage area in the past and will likely sustain this occupancy in the future.

If we now develop a projection on Bicentennial Coinage production and storage requirements, we assume, per the latest FRE information, that the following inventory of coins will be required on indicated dates by the banks to implement distribution.

	Million Pieces	Required
Dollar Coins	60-100	7/1/75
Half-Dollar	100-200	9/1/75
Quarter	300-400	1/1/76

For planning purposes, we will assume the mid-point requirement and assume that 1/2 of the coins will be produced at the Denver Mint beginning January, 1975. This facility will thus produce, store and provide accelerated delivery to the FRB as follows:

Denomination	Pieces	Bags	Storage Until	
Bollar Half-Dollar Quarter	40,000,000 75,000,000 175,000,000 290,000,000	40,000 37,500 43,750 121,250	July 1, 1975 Sept. 1, 1975 Jan. 1, 1976	

We would expect to level production at 26,000,000 pieces per month on the above three denominations, providing first the dollar, then the half-dollar, and last the quarter. On such a plan, we would expect shipment to begin about May 15 on the dollars, July 15 on the half-dollars, and October 15 on the quarters. Maximum storage requirements would occur on May 15 at a peak of 77,500 bags.

If we would relocate the cent and nickel storage function in its entirety to the Butler Building, we would free up vault storage space for an average of 17,750 bags of coin within the Mint, whereas maximum storage requirements for the Bicentennial Coins is 77,750 bags. Also, the 17,750 bag count will be exceeded by Bicentennial storage requirements for 10 months of the Calendar Year 1975. Undesirable features in relocating the cent and nickel storage operation to the Butler Building are:

- Will require moving 3,300 bags of cents and 560 bags of nickels daily from the Mint building to the Butler Building. This equates to 68 skids (carts) of coins moving counter to work flow and rear-dock unloading operations through the entire material flow.
- 2. If 20 skids per hour are moved from the dock to the Butler Building, the dock will be tied up 3-1/2 hours on coin movement only, counter the need to unload an average of four truckloads of purchased coinage strip, and move from the yard to the building, via the dock, some 200,000 to 300,000 pounds of coinage strip daily.
- The relocation of the function is inadequate to satisfy the requirement for storage space for Bicentennial Coin, and will necessitate additional coin handling effort and security measures.

As an alternate to exclusive outside storage of cents and mickels, the following is our plan of action.

- 1. Hove all gold bullion stored in Vault 0 to NYAO and West Point (if necessary), and install a vault door, at a cost of approximately \$3,300, at the East end.

  TARGET: Completion by January 1, 1974.

  This will provide storage for 31,000 bags.
- Use the Meszanine Vault, although access is difficult, on a once in and out basis for Bicentennial Coins. This will provide storage for 31,000 bags.
- Move 20 truckloads of Bicomtannial Coins to West Point equals 16,000 bags or request the Benver Federal Reserve Bank (one of two FRB long-term coin storage points) to accept early delivery in this amount.
- 4. As an alternate to Item 3 above, I believe we can find suitable space to store 16,000 bags of coins in a nonvault area within the Mint if security measures are relaxed somewhat. We will pursue this further.

Your concurrence is the above plan is requested.

cc: B. F. Prere

VF. W. Rhea, Denver

G. G. Ambrose

UNITED STATES GOVERNMENT

Memorandum

TO : Frank H. MacDonald, Deputy Director of the Mint DATE: July 11, 1973

FROM : Frank W. Rhea, Facilities Project Manager

SUBJECT: Additional Coin Storage at Denver Mint to Meet Bicentennial Requirements

- 1. This memo is in response to your telephone request for me to prepare concept plans to provide additional coin storage at Denver in anticipation of a requirement to produce and stockpile the new Bicentennial quarters, halves and dollars. The stated requirement is to have the capability of storing approximately three weeks of Denver 1¢ production (250 million pieces) in a new area, not utilizing any of the existing vaults inside the Denver Mint. (These existing vaults will be used for stockpile of Bicentennial special coins, plus for storage and shipment of the normal flow of nickels through dollars.)
- 2. Storage of 250 million 1¢ pieces equals 50,000 bags at \$50.00 per bag. Pennies are normally stacked 60 bags to the pallet, resulting in a requirement to store 833 pallets. The standard size of the pallet is 22" x 30" x 31" high. Thus one pallet would occupy 2' x  $2\frac{1}{2}$ ', or 5 sq. ft., and therefore 833 pallets stacked 3 high would require a net storage space of 1,400 sq. ft. To provide for access aisles, compartment partitions, etc. results in a gross space requirement of approximately 2,100 sq. ft.
- 3. My first recommendation to meet this requirement is to use the existing Butler Building No. 1, located in the southwest corner of the present mint site as shown on the attached drawing. This building has a net inside space of 3,500 sq. ft., with a 12 ft. eave height. It would be possible to stack pallets four high in this building, but at only three high it is feasible to store about 86,000 penny bags, or 432 million pieces, therein. This amounts to twenty-six days average Denver Mint penny production. In order to provide somewhat more security for this building, the two doors can be wired with anti-intrusion alarm devices connected to the existing security control console. Also, two or three ultrasonic alarm devices could be installed in the building and connected with the security console, /as an additional security measure, a guard could be posted full time to provide continuous human surveillance of the building while it is being used for coil storage and shipment operations. The coins would be moved in pallets across the existing loading dock adjacent to Fourteenth Street, picked up by forklifts operating at ground level and moved to the storage compartments within the building. Shipment can be handled by spotting trucks at the overhead door and loading with forklifts. Some strip coils normally stacked in the area in front of the door would have to be relocated to provide space for shipping. Lastly,



the building can be used for this operation without any real interference with current operations, as the small volume of coin bags and other miscellaneous items presently stored in this building can be relocated to unused areas in the Mint.

- 4. An alternative would be to construct a new one-story concrete vault addition connected to the Mint annex, as shown in red on the attached drawing. To provide the gross storage space required and sufficient shipment area, this addition should have the dimensions as shown, or a total area of 2,760 sq. ft. It is estimated that these reinforced concrete vaults could be constructed at about \$30.00 per sq. ft. which amounts to \$83,000. There would be additional costs for vault doors and miscellaneous items bringing the cost to about \$100,000. Although this alternative would provide more secure storage, it is not recommended that we spend \$100,000 in improvements at the present Mint due to our expected relocation to the new Mint in six or seven years. This alternative would eliminate 32 of the existing 136 employee parking spaces.
  - 5. There is vault space within the Denver Mint which has not been used recently for operational coin storage. Vault space presently being used for coins is on the basement level. There is a vault on the mezzanine level which can be placed into operation, preferably on a one-time in and out basis (because of difficulties with access), for storage of the Bicentennial quarters, halves and dollars. Approximately 20,000 bags of these coins can be stored in this vault. A similar sized vault on the first floor level is about 50 percent occupied presently with bullion. The bullion could be consolidated at one end of the vault and the remaining one-half used for Bicentennial stockpiling in the amount of 10,000 bags. Thus, there is a storage potential for 30,000 bags within the Mint, in addition to the 100,000 bags storage presently being utilized.

Birentennial Can Storage



Bending Componies



#### DEPARTMENT OF THE TREASURY

Fiscal Service, Bureau of Government Financial Operations

[Dept. Circular 570; 1975 Rev.]

### COMPANIES HOLDING CERTIFICATES OF AUTHORITY AS ACCEPTABLE SURETIES ON FEDERAL BONDS AND AS ACCEPTABLE REINSURING COMPANIES

JULY 1, 1975.

This circular is published annually, as of July 1, solely for the information of Federal bond-approving officers and persons required to give bonds to the United States. Copies of this circular may be obtained from: Audit Staff, Bureau of Government Financial Operations, Treasury Department, Washington, D.C. 20226. Telephone: (202) 964–5284. Interim changes in the circular are published in the Federal Register as they occur.

The following companies, except where otherwise noted, have complied with the law and the regulations of the Treasury Department and are acceptable as sureties on Federal bonds, to the extent and with respect to the localities indicated opposite

their respective names.

JOHN K. CARLOCK, Fiscal Assistant Secretary.

COMPANIES HOLDING CERTIFICATES OF AUTHORITY FROM SECRETARY OF THE TREASURY UNDER SECTIONS 6 TO 13 OF TITLE 6 OF THE UNITED STATES CODE AS ACCEPTABLE SURETIES ON FEDERAL BONDS, INCLUDING REINSURANCE [See Note (a)]

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorporated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
AID Insurance Company (Mutual), Des Moines, Iowa	3,101	Ariz., Ark., Cal., Colo., Idaho, Ill., Ind., Iowa, Kans., Minn., Mo., Mont., Nebr., N. Mex., N. Dak., Okla., Oreg., S.Dak., Tex., Utah, Wash., Wis., Wyo.	IOWA-Ariz., Cal., Colo., D.C., Idaho, Ill., Kans., Minn., Nebr., N. Dak., Okla., Oreg., S. Dak., Utah, Wis., Wyo
Accredited Surety and Casualty Company, Inc., Orlando, Florida	112	Fla., Ga.	FLA.—D.C.
The Aetna Casualty and Surety Company, Hartford, Conn.	20,514	All	CONN.—All.
Aetna Fire Underwriters Insurance Company, Hartford, Conn.	761	All except Ala., C.Z., Guam, Oreg., Puerto Rico, S.C., Virgin Islands.	CONND.C., Md., wPa.
Aetna Insurance Company, Hartford, Conn.	10,012	All except C.Z., Guam.	CONN.—All except C.Z., Guam, Hawaii, Virgin Islands.
Aetna Life and Casualty Company, Hartford, Comm.	82,276	Conn.	CONND.C., Mont.
Allegheny Mutual Casualty Company, Meadville, Pa.	86	Alaska, Fla., Ill., Ind., La., Md., Mich., N.J., Ohio, Pa., Wis.	PAD.C., sFla., nIll., Ind., Md., eMich., N.J., Ohio, eVa., eWis.
Allied Fidelity Insurance Co., Indianapolis, Ind.	131	Ala., Alaska, Ariz., Cal., Colo., Del., Ga., Idaho, Ind., Kans., Ky., La., Mass., Minn., Miss., Mo., Mont., N.Mex., N.Dak., Okla., Oreg., Tenn., Tex., Utah, Wis., Wyo.	IND. — Ariz., Cal., D.C., Kans., eKy., meLa., Mass., Minn., sMiss., Okla., evTenn., sTex.
Allied Insurance Company, Philadelphia, Pa.	447	All except Hawaii, La., Puerto Rico, Vt., Virgin Islands.	CALD.C., Tex.
Allied Surety Company, Portland, Me.	41	Pa	PAD.C.
Allstate Insurance Company, Northbrook, Ill.	65,464	All except C.Z., Guam, Virgin Islands.	Illccal., Colo., Conn., D.C., mFla., nGa., sInd., Kans., eMich., sMiss., N.J., eN.Y., wN.C., nOhio, ePa., sTex., wVa., eWis.
American Agricultural Insurance Company, Park Ridge, Ill.	1,751	Ariz., Colo., Fla., Ga., Idaho, Ill., Ind., Iowa, Mo., N.Mex., N.C., N. Dak., Oreg., Pa., S.C., Tex., Wash., Wis., Wyo. (Reinsurance only in Kans., Mass., N.Y., Va.)	IND.—D.C.
American Automobile Insurance Company, San Francisco, Cal.	7,274	All except C.Z., Guam, Puerto Rico, Virgin Islands.	MOAll except C.Z., Guam, Virgin Islands.

<sup>\*</sup>See footnotes at end of table.

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorpo- rated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
American Bonding Company,	79	Alacka Anta Anta Cal Cal	
Los Angeles, Cal.	-"	Alaska, Ariz., Ark., Cal., Colo., D.C., Idaho, Iowa, Kans., Miss., Mo., Mont., Nebr., Ney., N.Mex., Oreg., Utah.	NEBRAlaska, Ariz., Ark., nesCal., Colo., D.C., Idaho, Iowa, sMiss, Mo., Mont., Nev., N.Mex., Oreg., Utah, wWash
American Casualty Company of Reading, Pennsylvania, Chicago, Ill.	3,159	All except C.Z., Guam, Virgin Islands	PAAll except Guam, Virgin Islands.
American Credit Indemnity Company of New York, Baltimore, Md.	1,712	Cal., Colo., Conn., Del., Ill., Ind., Iowa, Me., Md., Mass., Minn., Mo., N.B., N.J., N.Mex., N.Y., N.C., Ohio, Okla., Pa., R.I., Vt., Wash., W. Va.	N.Y.—D.C.
The American Druggists' Insurance Company, Cincinnati, Ohio	173	Ala., Fla., Ga., Ill., Ind., Iowa, Ky., Md., Mich., Miss., R.Y., N.C., Ohio, Tenn., Tex., Va., W.Va., Wis.	OHIO-D.C.
American Economy Insurance Company, Indianapolis, Ind.	3,470	All except C.Z., Conn., Guam, Hawaii, Mass., N.J., Puerto Rico, Virgin Islands.	IND. —All except C.Z., Guam, Puerto Rico, Virgin Islands.
American Empire Insurance Company, Watertown, N.Y.	1,289	All except Alaska, C.Z., Guam, Fuerto Rico, Virgin Islands.	N.Y.—Ariz., Cal., Colo., Conn., Del., D.C., eIll., sInd., nIowa, Ky., Me., Mi., Mich., Minn., Mont., Nebr., N.H., N.J., N.Mex., N.Dak., nOhio, Pa., R.I., S.Dak., Tenn., Utah, Vt., wMis.
American Employers' Insurance Company, Boston, Mass.	3,665	All except Guam, Puerto Rico-	MASSAll except Guam.
American Fidelity Company, Manchester, N.H.	418	Coun., Iowa, Me., Mass., Miss., N.H., R.I., Vt.	VT.—All except C.Z., Guam, Kans., Puerto Rico, Virgin Islands.
American Fidelity Fire Insurance Company, Woodbury, N.Y.	524	All except Alaska, C.Z., Colo., Guam, Hawaii, Kans., Mo., Nebr., N.H., Virgin Islands.	N.YAriz., Cal., D.C., nGa., Idaho, nIll., La., Md., Mich., Mont., Nev., N. Max., Oreg., Puerto Rico, Utah, eVa., Wash., Wis.
American Fire and Casualty Company, Hamilton, Ohio	739	Ala., Ark., Colo., D.C., Fla., Ga., Kans., Ky., La., Md., Miss., Mo., N.C., Okla., S.C., Tenn., Tex., Va.	FLA.—Ala., Ark., Colo., D.C., Ga., Kans., Ky., La., Md., Miss., Mo., N.C., Okla., S.C., Tenn., Tex., Va.
American and Foreign Insurance Company, New York, N.Y.	793	All except C.Z., Del., Guam, La., Oreg., Puerto Rico, S.C., Va., Virgin Islands.	N.YD.C., Tex.
American General Insurance Company, Houston, Tex.	16,880 _	Mich., Pa., Tex.	Tex.—All except Guam, Puerto Rico, Virgin Islands.
American Guarantee and Liability Insurance Company, Chicago, Ill.	778	All except Ala., C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.	N.Y.—Alaska, Cal., Conn., D.C., nFla., nsGa., nsIll., nInd., Me., Md., Mass., eMich., Minn., Mo., N.H., N.J., N.Mex., Ohio, Pa., nswTex., Vt.
American Home Assurance Company, New York, N.Y.	2,347	All except Ark., C.Z., Guam, Puerto Rico, Virgin Islands.	N.Y.—D.C.
American Indemnity Company, Galveston, Tex.	545	Ala., Cal., Colo., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Miss., Mo., Mont., N. Mex., N.C., Ohio, Okla., S.C., Tenn., Tex., Va., Wis., Wyo.	TEX.—All except Alaska, wArk., C.Z., Gaum, Hawaii, wMich., nOkla., Puerto Rico, Virgin Islands, wVa.
The American Insurance Company, Principal Office: Newark, N.J. Home Office: San Francisco, Cal.	14,070	All except C.Z., Guam, Virgin Islands	N.J.—All except C.Z., Virgin Islands.
American International Insurance Company, New York, N.Y.	284	All except C.Z., Del., Guam, Hawaii, N.H., Puerto Rico, Virgin Islands.	N.Y.—D.C.
American Liberty Insurance Company, Birmingham, Ala.	166	All except Alaska, Ariz., Ark., C.Z., Conn., Del., D.C., Guam, Hawaii, Kans., Ma., Mass., Mich., Nev., N.H., N.J., N.Mex., N.Dak., Ohio, Oreg., Fuerto Rico, R.I., S.C., S.Dak., Vt., Virgin Islands, W.Va., Wis.	ALA.—Cal., Colo., D.C., Fla., Ga., Iowa, Kans., Ky., La., Mass., Minn., Miss., Mo., Nebr., Okla., Tenn., Tex.
American Hanufacturers Mutual Insurance Company, Long Grove, Ill.	1,833	All except C.Z., Guam, Okla., Puerto Rico, Virgin Islanda.	ILL.—All except C.Z., Guam, N.Y., Virgin Islands.
American Motorists Insurance Company, Long Grove, Ill.	1,739	All except Del., Guam, N.H., Virgin Islands-	Ill.—All except C.Z., Guam, Virgin Islands.
American Mutual Liability Insurance Company, Wakefield, Mass.	1,468	All except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands, Wis.	MASS.—D.C.
American Mational Fire Insurance Company, Los Angeles, Cal.	548	All except C.Z., Conn., Guam, La., He., Mich., N.J., Fuerto Rico, S.C., Virgin Islanda.	N.Y.—A11.

<sup>\*</sup>See footnotes at end of table

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorpo- rated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
American Re-Insurance Company, New York, N.Y.	4,111	All except Guam, Virgin Islands	N.YAll except Guam.
American States Insurance Company, Indianapolis, Ind.	8,361	All except C.Z., Conn., Guam, Mass., N.Y., Puerto Rico, Virgin Islands.	INDAll except C.Z., Guam, Mass., Puerto Rico, Virgin Islands.
Arkwright-Boston Manufacturers Mutual Insurance Company, Waltham, Mass.	8,888	Cal., Colo., Conn., D.C., Ill., Ind., Iowa, Md., Mass., Mich., Minn., Mo., Nebr., Nev., N.H., N.J., N.Mex., N.C., Ohio, R.I., Tex., Utah, Vt., Wash., Wyo.	MASSD.C.
Associated Indemnity Corporation, San Francisco, Cal.	1,549	All except C.Z., Guam, Virgin Islands-	CAL.—All except C.Z., Guam, Virgin Islands.
Atlantic Insurance Company, Dallas, Tex.	1,123	All except C.Z., Colo., Conn., Del., Guam, Hawaii, Idaho, Iowa, La., Me., Mass., Nebr., N.H., N.Y., N.Dak., Oreg., Puerto Rico, R.I., Vt., Va. Virgin Islands, Wash., Wis., Wyo.	TEX All except Alaska, C.Z., Guam, Hawaii, eN.Y., Puerto Rico, Virgin Islands.
Atlantic Mutual Insurance Company, New York, N.Y.	4,940	All except Ala., C.Z., Guam, Hawaii, Virgin Islands.	N.Y.—D.C.
Auto-Owners Insurance Company, Lansing, Mich.	8,054	Ala., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., Mich., Minn., Mo., Nebr., N.C., N.Dak., Ohio, S.C., S.Dak., Tenn., Wis.	MICH D.C., nsFla., Ill., Ind., Iowa, Minn., Mo., N. Dak., Ohio, S.Dak.
Balboa Insurance Company, Newport Beach, Cal.	1,807	All except Ala., Ark., C.Z., Kans., La., Mass., Miss., Nebr., N.H., N.J., N.C., N. Dak., Fuerto Rico, R.I., S.C., S.Dak., Tenn., Vt., Vaí, Virgin Islands, W.Va., Wis.	CALD.C., Nev., wWash.
Bankers Multiple Line Insurance Company, Chicago, Ill.	925	All except C.Z., Del., Guam, Idaho, Kans., La., Me., Oreg., Puerto Rico, S.C., Tenn., Virgin Islands.	IOHA-D.C.
Bankers and Shippers Insurance Company of New York, Burlington, N.C.	333	All except C.Z., Guzm, Puerto Rico, Virgin Islands.	N.Y.—mAla., Ariz., Ark., Del., D.C., nFla., nGa., sInd., sIowa, eKy., Me., Mass., Mich., Minn., sMiss., wMo., N.H., N.J., sOhio, wOkla., R.I., S.Dak., nwTex., Wyo.
Boston Old Colony Insurance Company, New York, N.Y.	605	All except C.Z., Guam	MASS.—Ala., Alaska, Ark., ncCal., Conm., Del., D.C., sFla., Ga., Hawaii, Idaho, Kans., La., Me., Md., Minn., Miss., eMo. Mont., Nebr., N. Mex., wseN.Y., N.C., S.C., Wyo.
The Euckeye Union Insurance Company, Columbus, Ohio	2,794	D.C., Fla., Ill., Ind., Kans., Ky., Mich., Mo.,N.Y., Ohio, Pa., Va., W.Va.	OHIO-D.C., Ill., Ind., Ky., Mich., Minn., Pa., eTenn., Va., W. Va.
The Camden Fire Insurance Association, Philadelphia, Pa.	4,301	All except Ark., C.Z., Del., Ga., Guam, Hawaii, Idaho, La., Me., Miss., Mont., Nebr., N.H., Oreg., Puerto Rico, S. Dak., Tenn., Tex., Virgin Islands, Wash.	N.JD. C.
Capitol Indemnity Corporation, Madison, Wis.	214	Ariz., Fla., Idaho, Ill., Ind., Iowa, La., Mich., Minn., Mo., Mont., N. Mex., N.Dak., Okla., S.Dak., Tex., Wis., Wyo.	WISD.C., Fla., nGa., Idaho, Ill., Ind., Iowa, Kans., La., Mich., Minn., wMo., Mont., N.Dak., wOkla., S.Dak.
Cascade Insurance Company, Minneapolis, Minn.	238	Alaska, Ariz., Cal., Colo., Hawaii, Idaho, Ind., Minn., Mont., Nev., Oreg., Utah, Wash.	WASE All except C.Z., Guam, Puerto Rico, Virgin Islands.
Centennial Insurance Company, New York, N.Y.	1,576		N.YD.C.
The Central National Insurance Company of Omaha, Omaha, Nebr.	430	All except C.Z., Guam, Hawaii, N.Y., Virgin Islands.	NEBRnAla., Ariz., eArk., ceCal., Conn. Del., D.C., Idaho, sIll., sInd., nIowa, Kans., wKy., eLa., Me:, Md., wMich., sMiss., wMo., Nev., N.J., N.Mex., eN.C., nOkla.
Century Indemnity Company, Hartford, Conn.	636	All except C.Z., Guam, Hawaii, Oreg., Puerto Rico, Virgin Islands.	CONND.C., Md., wPa.
The Charter Oak Fire Insurance Company, Hartford, Conn.	1,678	all except C.Z., Guam, Virgin Islands	CONN All except C.Z., Guam, Puerto Rico, Virgin Islands.
The Cincinnati Insurance Company, Cincinnati, Ohio		Ma., Ariz., Fla., Ga., Ill., Ind., Ky., Mich., N.C., Ohio, Pa., S.C., Tenn., Va., Wiz.	OHIO-mAla., D.C., sFla., nGa., sInd., Ky.

<sup>\*</sup>See footnotes at end of table.

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorporated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Colonial Surety Company, Philadelphia, Pa.	- 212	Del., N.J., Pa.	PA.—D.C.
Commercial Insurance Company of Newark, N.J., New York, N.Y.	2,500	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.J.—All except Guam.
Commercial Union Insurance Company, Boston, Mass,	14,574	All except C.Z., Guan	MASS.—All except C.Z., Guam.
The Commetticut Indemnity Company, Hartford, Conn.	698	All except Alaska, C.Z., Del., Guam, Hawaii, Oreg., Fuerto Rico, S.C., Virgin Islands.	CONNAll except Alaska, esCal., C.Z., Guam, Hawaii, Oreg., Virgin Islands, Wash.
Consolidated Insurance Company, Indianapolis, Ind.	419	Fla., Ill., Ind., Ky., Mich., Ohio, Wash. Wis.	INDD.C., Ill., Ky., Mich., Ohio.
Compolidated Mutual Insurance Company, Brooklyn, N.Y.	923	All except Ala., Alaska, C.Z., Del., Guam, La.	W.Y.—D.C.
Continental Casualty Company, Chicago, Ill.	6,985	All except Guan	ILLAll except C.Z., Quam, Virgin Islands.
The Continental Insurance Company, New York, N.Y.	11,838	All	N.Y.—All except Guam.
Continental Western Insurance Company, Des Moines, Iowa	784	Iowa, Kans., Minn., Mo., Nebr., N.Dak., S.Dak., Wis.	IOWA-D.C.
Cornhusker Casualty Company, Omaha, Nebr.	244	Colo., Iowa, Kans., Nebr., S. Dak. Wyo.	NEBR D. C.
Commopolitan Hutual Insurance Company, New York, N.Y.	568	Ala., Cal., Conn., Fla., Ga., Ill., Mass., N.J., N.Y., Pa., R.I., S.C., Vt.	N.YD.C.
Cotton States Mutual Insurance Company, Atlanta, Ga.	633 ,	Ala., Fia., Ga., ii.C.	GAAla., D.C., Fla.
Covenant Mutual Insurance Company, Hartford, Conn.	808	Cal., Conn., N.H., Oreg., Wash.	COMN.—cesCal., D.C.
Cumis Insurance Society, Inc., Madison, Wis.	727	All-	WIS.—nsAla., Colo., D.C., Fla., Ill., Md., Mich., Nev., Utah.
Dependable Insurance Company, Inc., Jacksonville, Fla.	127	Ala., Fla., Ga., Md., Mo., M.C., S.C., Va.	FLA.—D.C.
Empire Pire and Marine Insurance Company, Omaha, Webr.	261	All except Ark., Cal., C.Z., Conn., Del., D.C., Guam, Ky., La., Mass., Me., Md., M.H., M.J., M.Y., Oreg., Pa., Puerto Rico, R.I., Temn., Tex., Va., Virgin Islands, W. Va.	MEBR.—D.C.
The Employers' Fire Insurance Company, Boston, Mass.	1,845	All except C.Z., Guam, Puerto Rico	MASS.—All except C.Z., Guam.
Employers Mutual Casualty Company, Des Moines, Iowa	3,063	All except Ala., C.Z., Guam, La., Puerto Rico, Virgin Islands.	IOWA—Alaska, Colo., D.C., Ill., Ind., Kana., Md., Minn., Miss., Mo., Nebr., N.C., N.Dak., Ohio, Okla., Oreg., Pa., S.C., S.Dak., Wis.
Employers Mutual Liability Insurance	8,849	All except C.Z., Virgin Islands-	WIS.—All except C.Z., Guam, Puerto Rico, Virgin Islands.
Company of Wisconsin, Wausau, Wis.  Employers Reinsurance Corporation, Kanaas City, Mo.	4,945	Ala., Alaska, Arir., Ark., Cal., Colo., Conn., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Me., Md., Mass., Mich., Minn., Miss., Mo., Mont., Nebr., Nev., N.H., N.J., M.Max., N.Y., N.C., N.Dak., Ohio, Okla., Oreg., Pa., R.I., S.C., S.Dak., Tenn., Tex., Utah, Vt., Wash., W.Va., Wis., Wyo. (Reinsurance only in Hawaii, Puerto Rico; Coinsurance only in Va.)	HOAll except Guam.
Equitable General Insurance Company, Fort Worth, Tex. 18	1,193	All except C.Z., Conn., Del., Guam, Hawaii, Me., Md., Mass., Mich., N.H., N.J., N.Y., Oreg., R.I., S.C., Vt., Virgin Islands, W.Va.	TEX.—Ala., Ariz., Ark., Cal., Colo., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., La., Minn., Miss., Mo., Nebr., Nev., N.Mex., N.Dak., Ohio,
			Okla., Pa., S.Dak., Temm., Utah, Va., Wash.

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	Underwriting	A CONTRACTOR OF THE CONTRACTOR	
Names of companies and locations of principal executive offices	limitations	outery business. [See note (c)]	State or other area in which incorpo- rated (in capitals), and judicial districts in which process agents have been appointed (letters precedin names of States indicate judicial districts). [See note (d)]
Farmers Alliance Mutual Insurance Company, McPherson, Kans.	1,107	Ark., Colo., Idaho, Ill., Iowa, Kans., Md., Mass., Mich., Minn., Mo., Mont., Nebr., N.H., N.J., N.Mex., N.Y., N.C., N.Dak., Ohio, Okla., S.C., S.Dak., Tex., Vt., Wash., Wyo.	KANS.—Colo., D.C., Mo., Nebr., N.Mex., N.Dak., Okla., S.Dak., Tex.
Farmers Elevator Mutual Insurance Company, Des Moines, Iowa	754	Colo., Ill., Iowa, Kans., Minn., Mo., Nebr., N. Dak., Okla., S. Dak., Tex., Wyo.	IOWA-Colo., D.C., Ill., Kans., Nebr., Okla., S. Dak.
Farmers Home Mutual Insurance Company, Minneapolis, Minn.	1,211	Ariz., Cal., Colo., Idaho, Iowa, Minn., Mont., Nev., N.Dak., Oreg., S.Dak., Utah, Wash., Wis.	MINN. —Alaska, Ariz., Cal., D.C., Nev., Utah.
Farmers Mutual Hail Insurance Company of Iowa, Des Moines, Iowa	2,435	Iova	IONA-D.C.
Federal Insurance Company, New York, N.Y.	10,980	All	N.J.—A11,
Federated Mutual Insurance Company, Owatonns, Minn.	3,737	All except Alaska, C.Z., Del., Guam, Me., Puerto Rico, Virgin Islands.	MINN.—Ala., Ark., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., Miss., Mo., Mont., Nebr., N.C., N. Dak., Okla., S. C., S. Dak., Tenn., Va., W.Va., Wis.
The Fidelity and Casualty Company of New York, New York, N.Y.	4,261	All except Guam, Virgin Islands	N.Y.—All except Guam, Hawaii, Virgin Islands.
Fidelity and Deposit Company of Maryland, Baltimore, Md.	4,232	All except Guar	MD.—All except Guam.
Financial Indemnity Company, Los Angeles, Cal.	309	Ala., Alaska, Ariz., Cal., Colo., Fla., Idaho, Ind., Oreg., Utah, Wash.	CAL.—Ariz., Colo., D.C., who,, Oreg.,
Fireman's Fund Insurance Company, San Francisco, Cal.	34,280	All except C.Z.	CAL.—All.
Firemen's Insurance Company of Newark, New Jersey, New York, N.Y.	13,637	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.JAll except C.Z.
Pirst General Insurance Company, Trevose, Pa.	208	Ariz., Ark., Cal., Colo., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Ky., La., Md., Miss., Mo., N.J., N.C., Pa., R.I., Tex., Utah, Wash.	GA.—D.C.
First Insurance Company of Hawaii, Ltd., Honolulu, Hawaii	807	Alaska, Ariz., Cal., Colo., Guam, Hawaii, Ill., Ind., La., Minn., Mo., N.Y., Oreg., Utah, Wash.	HAWAII-D.C.
First National Insurance Company of America, Seattle, Wash.	751		WASH.—All except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
First State Insurance Company, Boston, Mass.	2,806	Del., Mass.	MASS.—D.C.
Fremont Indemnity Company, Los Angeles, Cal.	292	Ariz., Cal., N.Mex., Tex.	CAL.—D.C.
General Fire and Casualty Company, Carle Place, N.Y.	644	All except C.Z., Puerto Rico.	N.Y.—D.C.
General Insurance Company of America, Seattle, Wash.	3,213	A11	WASH.—All.
General Reinsurance Corporation, New York, N.Y.	14,783	All except C.Z., Guam, Hawaii, Virgin Islands.	DELAll except C.Z., Guam, Virgin
The Glens Falls Insurance Company, New York, N.Y.	1,599	All except C.Z., Guam, Virgin Islands	N.Y.—D.C.
Globe Indemnity Company, New York, N.Y.	3,357	All except C.Z., Guam, Puerto Rico, Virgin Islanda.	N.Y.—All except Alaska, Guam, Virgin Islands.
Grain Dealers Mutual Insurance Company, Indianapolis, Ind.	851	All except Ala., Alaska, C.Z., Conn., Del., D.C., Fla., Guam, Idaho, Me., Md., Hass., Mont., N.H., N.Dak., N.J., Fa., Puerto Rico, R.I., Utah, Vt., Virgin Islands.	IND.—eArk., Colo., D.C., Ill., Iowa, Kans., Nebr., Ohio, wOkla.
Granite State Insurance Company, Manchester, N.H.	419	All except C.Z., Conn., Del., Guam, Hawaii, Puerto Rico, Virgin Islands.	N.HAll except Guam, Puerto Rico.
Great American Insurance Company, Los Angeles, Cal.	10,740	All except C.Z.	T.Y.—All.
Great Northern Insurance Company, Minneapolis, Minn.	560	Ala., Ariz., Colo., D.C., Ill., Ind., Iowa, Me., Md., Minn., Miss., Mo., Mont., Nebr., Ney., N.Mex., N.Y., N.Dak., R.I., S.Dak., Vt., Wia., Wyo.	GINND.C., nsIII., Iowa, Mo., Mont., N.Dak., S.Dak., Wis.
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Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorporated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Greater Hew York Mutual Insurance Company, New York, N.Y.	2,993 *	Ala., Ariz., Cal., Colo., Conn., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kans., Ky., Me., Md., Mass., Hich., Minn., Miss., Ho., Mont., Hebr., Nev., N.H., H.J., N.Mex., H.Y., N.C., H.Dak., Ohio, Okla., Pa., Puerto Elco, R.I., S.Dak., Tex., Utah, Vt., Va., Wash., W.Va., Wis., Wyo.	N.Y.—D.C.
Gulf American Fire and Casualty Company, Montgomery, Ala.	247	Ala., Fla., Ga., La., Miss., S.C., Tenn.	ALA.—Alaska, D.C., mnGa., skiss.
Gulf Insurance Company, Dallas, Tex.	3,852	All except C.Z., Conn., Del., Guam, Idaho, Puerto Rico, Virgin Islands.	MO. —All except C.Z., Guam, Hawaii, N.J., eN.Y., Puerto Rico, Virgin Islands.
Hallmark Insurance Company, Inc., Madison, Wis.	136	Ala., Alaska, Ariz., Del., D.C., Ga., Idaho, Ind., La., Hont., H.Mex., N.Dak., Okla., Oreg., Utah, Va., W.Va., Wash., Wis., Wyo.	WISD.C.
The Hamilton Mutual Insurance Company of Cincinnati, Ohio, Cincinnati, Ohio	350	Ind., Ky., Mich., Ohio	OHIO-D.C.
The Hanover Insurance Company, Worcester, Mass.	3,859	All except C.2., Guam, Puerto Rico, Virgin Islands.	N.H.—nAla., eArk., nCal., Conn., Del., D.C., nmFla., nmGa., Ill., Ind., wKy., eLa., Me., Md., Mich., Mo., N.J., nwsN.Y., Ohio, Pa., R.I., nesTex., eWis
Harleysville Mutual Insurance Company, Harleysville, Pa.	4,089	Cal., Colo., Del., D.C., Ga., Ill., Ind., Iowa, Kans., Md., Mich., Minn., Miss., Mo., N.J., N. Mex., H.C., Ohio, Okla., Pa., S.C., Tex., Utah, Va., W. Va.	PA.—D.C.
Hartford Accident and Indemnity Company, Hartford, Conn.	10,459	All except Guam	CONN-All except Guam, Virgin Islands.
Hartford Casualty Insurance Company, Hartford, Conn.	3,514	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.JAll except C.Z., Guam, Puerto Rico, Virgin Islands.
Hartford Fire Insurance Company, Hartford, Conn.	22,831	All except C.Z.	CONN.—Ariz., Cal., D.C., Guam, Hawaii, La., N.Y., Va.
Hawkeye-Security Insurance Company, Des Hoines, Iowa	1,194	Ariz., Colo., D.C., Idaho, Ill., Ind., Iowa, Kans., Md., Mich., Minn., Mo., Mont., Nebr., Nev., N. Mex., N. Dak., Ohio, Fa., S. Dak., Tex., Utah, Va., Wis., Wyo.	IOWA-Colo., D.C., nsFla., III., sInd., Kans., wMich., Mo., Nebr., N. Mex., S. Dak., Wyo.
Heritage Insurance Company of America, Lincolnwood, Ill.	226	Fla., Ga., Ill., No.	IILD.C., eVa.
Highlands Insurance Company, Houston, Tex.	3,516	All except C.Z., Guam, Virgin Islands.	TEX.—All except nsAla., wArk., esCal., C.Z., Conn., Del., nsFla., msGa., Gumm, Hawaii, esIll., nInd., nIowa, Ky., Mass., wMich., nMiss., wMo., Nev., N.H., nweN.Y., N.C., neOkla., mPa., Puerto Rico, R.I., wmTenn., wVa., Virgin Islands, eWash., nW.Va., eWis.
Highlands Underwriters Insurance Company, Houston, Tex.	510	Ala., Ark., Cal., Fla., La., Miss., S.C., Tex	TEX.—D.C.
The Home Indemnity Company, New York, N.Y.	2,026	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.H.—All except Alaska, cCal., C.Z., Guam, Mass., N.Mex., wsN.Y., sOhio, Oreg., wPa., Puerto Rico, S.C., eTenn., Virgin Islands, eWash.
The Home Insurance Company, Hew York, M.Y.	11,893	A11	N.HAll except Alaska, ceCal., C.Z., Del., Guam, Hawaii, nInd., mLa., N.Mex., M.Y., nOhio, Oreg., wPa., Puerto Rico, S.C., Virgin Islands, wWash., wWis.
Houston General Insurance Company, Fort Worth, Tex. 2*	425	Ala., Ark., Colo., Iowa, Kans., Ry., La., Hiss., Mo., N.Mex., N.Dak., Okla., S.C., S.Dak., Tex.	TEX.—D.C.
Hudson Insurance Company, New York, N.Y.	444	D.C., Iowa, N.Y., Utah (Reinsurance only in Tex.)	N.Y.—D.C.
IHA Reinsurance Company, Philadelphia, Pa.	5,353	All except C.Z., Guam, Ill., Me., Virgin Islands.	DELAll except C.Z., Guam, mLa., Mass., ePa., Virgin Islands.

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Names of companies and locations of principal executive offices	Underwriting limitations (net limit on amy one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorpo- rated (in capitais), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Illinois National Insurance Co., Springfield, Ill.	699	Ill., Ind., Iowa, Rans., Ky., Minn., Mo., Nebr., N. Mex., Ohio, Tex.	ILL.—All except, C.Z., Guam, Puerto Rico, Virgin Islands.
Imperial Insurance Company, Los Angeles, Cal.	510	Ala., Ariz., Ark., Cal., Emvaii, Idaho, Ind., Iowa, La., Minn., Miss., Mo., Mont., Nebr., Nev., N.Mex., N.Y., N.C., N.Dak., Okla., Oreg., S.C., S.Dak., Utah, Va., Wash., Wis., Myo.	CAL.—Aris., eArk, D.C., Idaho, Ind., La., Minn., Nebr., Nev., N.Dak., nwOkla., Tenn., Va., wWash.
Indiana Insurance Company, Indianapolis, Ind.	2,544	Fla., Ill., Ind., Ky., Mich., Ohio, Wash., Wis.	INDD.C., Ill., Ky., Mich., Ohio.
Indiana Lumbermens Mutual Insurance Company, Indianapolis, Ind.	728	Cal., Ga., Ill., Ind., Iowa, Kans., Ky., Mich., Miss., Mo., N.C., Ohio, Okla., Pa., S.C., Tenn., Tex., Wash.	IND.—D.C.
Industrial Indemnity Company, San Francisco, Cal.	- 2,659	All except Ala., C.Z., Coun., Puerto Rico, Virgin Islands, W.Va.	CAL.—All except C.Z., nFla., mGa., Guam, eill., nIowa, Mass., wMo., esN.Y., eN.C. Puerto Rico, Virgin Islands, W.Va., wWis
Inland Insurance Company, Lincoln, Nebr.	430	Colo., Iowa, Eans., Minn., Hebr., N.Dak., Okla., S. Dak., Wyo.	NEBR.—Ariz., Colo., D.C., III., Iowa, Kans., Minn., eHo., Hont., N. Hex., N. Dak., Okla., S. Dak., Utah, Wash., Wyo.
Insurance Company of North America, Philadelphia, Pa.	28,723	All	PA.—All.
The Insurance Company of the State of Pennsylvania, New York, H.Y.	356	All except Ark., C.Z., Guan, Kans., Poerto Rico, Virgin Islands.	PAD.C.
Integrity Mutual Insurance Company, Appleton, Wis.	125	Iowa, Minn., Wis.	WISD.C., Kans., Mins., who., N. Dak.
International Fidelity Insurance Company, Newark, #.J.	103	Alaska, Arix., Del., Ill., Mass., Mich., Mo., Nev., N.J., N. Mex., N.Y., Okla., Oreg., Pe., Tex.	N.J.—Ariz., Del., D.C., Ga., nIII., sind., niowa, Md., Mass., Minn., New., seN.T., eN.C., N.Dek., nwokla., Fuerto Rice, S. Dak., nwTex., eVa., Wyo.
International Insurance Company, Morristown, H.J.	1,187	All except.C.Z., Del., Guam, Hawaii, La., S. C., Virgin Islands.	ILL.—All except Alaska, C.Z., Conn., Del., Guma, Me., Md., Hass., N.H., N.J., Ohio, Pa., Puerto Rico, R.I., eTenn., Vt., Virgin Islands, W. Va.
International Service Insurance Company, Fort Worth, Tex.	926	Alaska, Cal., C.Z., Nebr., N. Mex., Tex.	TEX.—D.C.
Investors Insurance Company of America, Teaneck, N.J.	246	н.у., н.ү.	N.J.—D.C.
Iowa dutual Insurance Company, DeWitt, Iowa	1,206	Colo., Idaho, Ill., Iowa, Kans., Hima., Ho., Hont., Mebr., M.C., N. Dak., Okla., Oreg., S.C., S. Dak., Wash., Wis., Wyo.	IOWA-mAla., Colo., D.C., sIII., Kans., Minn., Mont., Nebr., wN.C., wOkla., Oreg., S. Dak.
John Doere Insurance Company, Holine, Ill.	702	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.Y.—All except Ala., C.Z., Del., Guam, Idaho, Puerto Rico, Virgin Islands, sw. Va.
The Kansas Bankers Surety Company,	97	Kans., D.C.	KANS.—D.C.
Topeks, Kams.  Kamsas City Fire and Harine Insurance Company, New York, H.Y.	579	All except C.Z., Guam, Hawgii, Puerto Rico, Virgin Islands.	NO.—Ala., Alaska, Ark., Colo., D.C., nsFla., Ga., Ill., Iowa, Kans., Minn., Nebr., Okla., S.C., Tex., Va., Wis., Wyo.
Lakeland Fire and Casualty Company, Minneapolis, Minn.	175	Minn., N. Dak.	HINN.—D.C.
Laryers Surety Corporation,	190	Okla., Tex.	TEX.—D.C.
Dallas, Tex.  Leatherby Insurance Company, Fullerton, Cal.	1,992	All except C.Z., Conn., Guam, Nebr., Puerto Rico, Tenn., Virgin Islands.	N.Y.—Ariz., Cal., Colo., D.C., meFla., nmGa., Hawaii, Idabo, nInd., Nd., aMiss. Nont., Nev., N.J., N.Mex., eN.C., Ohio, Oreg., S.C., Utah, Va., Wash., Wyo.
Liberty Mutual Insurance Company, Boston, Mass.	29,106	All except Guam, Virgin Islands	MASS.—All except C.Z., Guen.

Underwriting

	Names of companies and locations of principal executive offices	limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorpo- rated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
	London Guarantee & Accident Company of New York, New York, N.Y.	688	All except Alaska, Ariz., C.Z., Conn., Guam, Idaho, Kams., La., N.Dak., Oreg., Puerto Rico, Virgin Islands.	N.YD.C.
	Lumbermens Mutual Casualty Company, Long Grove, Ill.	8,238	All except C.Z., Guam, Puerto Rico, Virgin Islands.	ILL.—All except C.Z., Guam, Virgin Islands.
	MGIC Indemnity Corporation,	708	All except Ala. Ark., C.Z., Guam, Hawaii, Kans., La., Oreg., Puerto Rico, S.C., Virgin Islands, W. Va.	N.Y.—D.C.
	Maine Bonding and Casualty Company, Portland, Ma.	671	Me., Mass., N.H., R.I., Vt.	ME.—Conn., D.C., Mass., N.H., R.I., Vt.
	The Manhattan Fire and Marine Insurance Company, Stamford, Conn.	677	All except Alaska, C.Z., Conn., Guam, Kans., Puerto Rico, S.C., Virgin Islands.	N.YD.C.
	Maryland American General Insurance Company, Houston, Tex.	1,187	N. Mex., Tex	TEXD.C., La., N. Mex., Okla.
	Maryland Casualty Company, Baltimore, Md.	9,747	All except Guam	1D.—All except Guam.
9	Massachusetts Bay Insurance Company, Worcester, Mass.	383	All except Ala., Alaska, Ariz., Ark., C.Z., Del., Guam, Hawaii, Idaho, Ky., La., Mont., Nev., N. Mex., N. Dak., Oreg., Puerto Rico, S. Dak., Utah, Virgin Islands, W. Va.	MASS.—Colo., D.C., nFla., Ga., Ind., Iowa, Kans., Ky., Me., Md., Mich., N.H., sOhio, Okla., wePa., R.I., S.C., Tenn., Tex., Vt., Wash., Wis., Wyo.
	The Mercantile and General Reinsurance Company of America, New York, N.Y. 3*	822	Ark., Cal., Conn., Del., D.C., Ill., Ind., Iowa., Kans., La., Md., Mass., Mich., Nebr., Nev., M.H., M.J., N.Y., Onio, Okla., Pa., Tenn., Tex., Utah, W.Va., Wis.	N.YD.C.
	Merchants Mutual Bonding Company, Des Moines, Iowa	48	Ariz., Iowa, Kans., Mont., Nebr., N. Dak., Okla., S. Dak., Tex.	IOWA-D.C., sIll., Nebr., wokla.
	Meritplan Insurance Company, Newport Beach, Cal.	426	Ariz., Cal., Colo., Ga., Nev., Utah	CAL.—D.C.
	Michigan Millers Mutual Insurance Company, Lansing, Mich.	1,850	All except Ala., Alaska, Ariz., C.Z., Ga., Guam, Hawaii, Idaho, La., Nev., N. Mex., Oreg., Fuerto Rico, R.I., Virgin Islands, W.Va., Wyo.	MICHeArk., nsCal., Colo., D.C., Ill., Ind., Iowa, Kans., eKy., Minn., Miss., Mo., Mont., Nebr., nwN.Y., N. Dak., Ohio, wOkla., S.Dak., wmTenn., Utah, wWash.
	Mid-Century Insurance Company, Los Angeles, Cal.	1,446	All except Ala., Alaska, C.Z., Conn., Del., D.C., Guam, Hawaii, Ky., La., Me., Md., Mass., Miss., N.E., N.J., N.Y., H.C., Pa., Fuerto Rico, R.I., S.C., Tenn., Vt., Va., Virgin Islands, W.Va.	CAL.—Ariz., Ark., Colo., D.C., Idaho, Ill., Ind., Iowa, Kans., Mich., Minn., Mon., Mont., Nebr., Nev., N.Mex., N.Dak., Okla., Oreg., S.Dak., Tex., Utah, Wash., Wis., Wyo.
	Midland Insurance Company, New York, N.Y.	1,094	All except C.Z., Guam, Virgin Islands.	N.YAlaska, D.C., Kams., Nebr., N.J., nOkla., wePa.
	Mid-States Insurance Company, Chicago, III.	252	Ala., Ariz., Cal., Colo., Fla., Ga., Idaho, Ill., Ind., Kans., Ky., La., Mich., Minn., Miss., Mo., Nebr., Nev., N.Mex., N.C., Ohio, Okla., S.C., Tenn., Tex., Utah, Va., Wash., Wis.	ILL.—All except sCal., C.Z., Guam, Kans., Mass., nwM.Y., mN.C., eOkla., R.I., S.Dak., sTex., Virgin Islands.
	Midwestern Casualty & Surety Company, West Des Moines, Iowa	83	Iova	IOWA-D.C.
	The Millers Casualty Insurance Company of Texas, Fort Worth, Tex.	233	Ark., Colo., D.C., Idaho, La., Hiss., Mo., Mont., N. Mex., Okla., Oreg., Tex., Wyo.	TEX.—Ark., D.C., Fla., La., Miss., Mo., N. Mex., Okla.
	The Hillers Mutual Fire Insurance Company of Texas, Fort Worth, Tex.	1,029	All except Alaska, C.Z., Conn., Del., Guam, Hawaii, Me., Md., Mich., Nev., N.H., Puerto Mico, R.I., S.C., Vt., Va., Virgin Islands, W.Va.	TEX.—All except Ala., Alaska, C.Z., Conn., Del., Guam, Hawaii, Idaho, Me., Md., Nev., N.H., N.C., Puerto Rico, R.I., S.C., Vt., Va., Virgin Islands, eWash., W. Va., Wyo.
	Millers' Mutual Insurance Association of Illinois, Alton, Ill.	2,280	All except Alaska, Ariz., Cal., C.Z., Conn., Dol., D.C., Guam, Hawaii, Idaho, Ky., La., Me., Mass., Nebr., Nev., N.H., N.Mex., Oreg., Puerto Rico, R.I., Utah, Virgin Islands.	ILL.—nmAla., Ark., Colo., D.C., Ind., Iowa, Kans., Minn., Mo., Mont., N.Dak., S.Dak.
	Millers National Insurance Company, Chicago, Illinois	505	All except Alaska, C.Z., Colo., Conn., Del., Guam, Hawaii, Kans., La., Me., Miss., Nev., N.H., Puerto Rico, Vt., Virgin Islands.	ILLAriz., sCal., Colo., D.C., Ind., Iowa, Kans., Ky., Mass., Mich., Minn., Mo., Mont., Nev., N. Mex., N. Dak., R.I., S. Dak., nwsTex., Utah, wWis., Wyo.

\*See footnotes at end of table.

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. (See note (b))	States and other areas in which licensed to transact surety business. (See note (c))	State or other area in which incorpo- rated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Mission Insurance Company, Los Angeles, Cal.	1,836	All except Ark., C.Z., Conn., D.C., Guam, Kans., Me., Mass., N.H., N.J., Ohio, Puerto Rico, R.I., Vt., Virgin Islands, W.Va.	CAL.—Ariz., D.C., Idaho, Oreg., wwash.
Mohawk Insurance Company, Allentown, Pa.	272	All except Ariz., C.Z., Conn., Del., Guam, Hawaii, Mo., N. Mex., Puerto Rico, Virgin Islands, Wyo.	N.YD.C.
National Automobile and Casualty Insurance Company, Los Angeles, Cal.	157	Alaska, Ariz., Cal., Colo., Hawaii, Idaho, Ill., Ind., Kans., La., Mo., Mont., Nev., N. Mex., Okla., Oreg., Tex., Utah, Wash., Wyo.	CALAll except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
National-Ben Franklin Insurance Company of Illinois, Chicago, Ill.	3,176	D.C., Ill., Ind., Iowa, Ky., Minn., N.Y., N.C., N. Dak., Wis.	IIID.C.
National Bonding and Accident Insurance Company, St. Louis, Mo.	166	Ala., Alaska, Ariz., Cal., Colo., Del., D.C., Idaho, Ind., Iowa, Kans., La., Minn., Miss., Mo., Mont., N. Mex., N.Y., N. Dak., Oreg., S.C., S. Dak., Tex., Utah, Va., Wash., Wyo.	N.YD.C., eMo.
National Fire Insurance Company of Hartford, Chicago, Ill.	6,324	All except C.Z., Guam, Virgin Islands	CONNAll except C.Z., Guam, Nev., Virgin Islands.
National Grange Mutual Insurance Company, Keene, N.H.	3,492	Conn., Del., D.C., Ill., Ind., Iowa, Me., Md., Mass., Mich., N.H., N.J., N.Y., N.C., Ohio, Pa., R.I., S.C., Tenn., Vt., Va., W.Va., Wis.	N.HAll except Alaska, C.Z., Guam, Hawaii, Virgin Islands.
National Indemnity Company, Omaha, Nebr.	2,553	All except C.Z., Guam, Hawaii, Mass., N.J., N.Y., Puerto Rico, Vt., Virgin Islands.	NEBRAll except Alaska, C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
The National Reinsurance Corporation, New York, N.Y.	1,883	All except Ala., C.Z., Conn., Fla., Ga., Guam, La., Me., Miss., Mo., N.C., Oreg., Puerto Rico, S.C., S. Dak., Temm., Va., Virgin Islands.	N.YD.C., sObio
National Standard Insurance Company, Houston, Tex.	326	La., N. Mex., Tex.	TEXD.C.
National Surety Corporation, Chicago, Ill.	8,406	All except Puerto Rico, Virgin Islands.	ILL.—All except Guam, mLa., Mass., nOhio, Puerto Rico, nTex., Virgin Islands.
National Union Fire Insurance Company of Pittsburgh, Pa., New York, N.Y.	1,139	All except C.Z., Guam, Puerto Rico, Virgin Islands.	PA.—All except Alaska, C.Z., Guam, Puerto Rico, Virgin Islands.
Nationwide Mutual Insurance Company, Columbus, Ohio	19,573	All except C.Z., Guam, Hawaii-	OHIO-D.C.
New England Reinsurance Corporation, Boston, Mass.	2,725	Cal., Conn., Del., D.C., Ga., Idaho, Ill., Ind., Iowa, Ky., Mass., Minn., Miss., Nev., N.J., Ohio, Okla., R.I., (Reinsurance only in Ark., Fla., Kans., N.H., S.C., Tex.)	MASS.—D.C.
New Hampshire Insurance Company, Manchester, N.H.	5,034	All except C.Z., Guam.	N.HAll except Guam.
New York Underwriters Insurance Company, Hartford, Conn.	2,062	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.Y.—All except C.Z., Guam, Puerto Rico, Virgin Islands.
Newark Insurance Company, New York, N.Y.	894	All except C.Z., Guam, Puerto Rico, Virgin Islands.	N.J.—All except Alaska, nCal., C.Z., Guam, Hawaii, Idaho, Virgin Islands, Wyo.
Niagara Fire Insurance Company, New York, N.Y.	1,280	All except C.Z., Guam	N.YAll except C.Z., Guam.
North American Reinsurance Corporation, New York, N.Y.	5,762	All except C.Z., Guam, Virgin Islands.	N.YAll except C.Z., Guam, Puerto Rico, Virgin Islands.
The North River Insurance Company, Morristown, N.J.	3,191	All except C.Z., Guam, Virgin Islands.	N.JAll except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
Northeastern Insurance Company of Hartford, Des Moines, Iowa	1,360	Cal., Colo., Conn., Ill., Iowa, Kans., N.H., N.J., N.Y., Ohio, Tex., W. Va.	CONND. C.
The Northern Assurance Company of America, Boston, Mass.	1,544	All except C.Z., Guam, Puerto Rico.	MASSAll except C.Z., Guam, Virgin Islands, sw. Va.
Northern Insurance Company of New York, Baltimore, Md.	1,742	All except C.Z., Guam, La., Puerto Rico, Virgin Islands.	N.YD.C., Me.
Northwestern National Casualty Company, Milwaukee, Wis.	1,034	All except Alaska, Ark., C.Z., Conn., Del., Guam, Hawaii, La., Me., Mass., Nev., N.E., N.J., N.Y., N.C., Oreg., Fuerto Rico, Utah, Vt., Va., Virgin Islands.	WISnsAla., Ariz., Cal., Colo., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., Mi., Mich., Minn., Mo., Mont., Nebr., N. Mex., Ohio, Okla., Pa., R.I., S. Dak., nesTex., Wash., W. Va.,
*See footnotes at end of table.			Wyo.

Names of companies and locations of principal executive offices	Underwritin limitation (net limit any one ris in thousans of dollars [See note	on States and other areas in which licensed to transact sk) surety business. [See note (c)] ds	State or other area in which incorporated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Northwestern National Insurance Company_of Milwaukee, Wisconsin, Milwaukee, Wis.	2,667	All except C.Z., Guam, Virgin Islands	WIS.—All except C.Z., Guam, Virgin Islands.
The Ohio Casualty Insurance Company, Ramilton, Ohio	8,616	All except C.Z., Guam.	OHIO-All except C.Z., Guam.
Onio Farmers Insurance Company, Westfield Center, Onio	3,307	All except Alaska, C.Z., Conn., Guam, Hawaii, Kans., La., Me., Puerto Rico, Virgin Islands.	OHIO-All except Alaska, C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
Oklahoma Surety Company, Tulsa, Okla.	142	Okla.	OKLAD.C.
The Omaha Indemnity Company, Omaha, Nebr	662	All except C.Z., Conn., Guam, La., N.H., N.J., Virgin Islands.	WISD.C., Nebr., eVa.
Oregon Automobile Insurance Company, Portland, Oreg.	858	Cal., Idaho, Nev., Oreg., Utah, Wash	OREGCal., D.C., Hawaii., Idaho, Nev., Utah, Wash.
Pacific Employers Insurance Company, Los Angeles, Cal.	1,670	A11-	CAL.—Ariz., Conn., Del., D.C., sFla., wKy., Md., Mass., N.Mex., N.Y., Ohio, R.I., wTex., W. Va., Wis.
Pacific Indemnity Company, Los Angeles, Cal.	4,109	All except C.Z., Guam, Virgin Islands	CAL.—All except Conn., Guam, Me., N.H., Vt., Virgin Islands.
Pacific Insurance Company, San Francisco, Cal.	4,956	Alaska, Ariz., Ark., Cal., Colo., D.C., Fla., Hawaii, Idaho, Ill., Ind., Iowa, Mich., Mont., Nev., N.J., N.Mex., N.Y., N.C., Okla., Oreg., Tex., Utah., Va., Wash., Wyo.	CAL.—D.C.
Pacific Insurance Company, Limited, Honolulu, Hawaii	1,420		HAWAIID.C.
Peerless Insurance Company, Keene, N.H.	2,031	All except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.	N.H.—All except Guam, Hawaii, Virgin Islands.
Pekin Insurance Company, Pekin, Ill.	229	Ill., Ind., Iowa	ILLD.C., Ind., Iowa.
Pennsylvania Manufacturers' Association Insurance Company, Philadelphia, Pa.	2,840	Del., D.C., Md., Mass., N.J., N.Y., Ohio, Pa., W.Va.	PA.—Del., D.C., Md., N.J.
Pennsylvania Millers Mutual Insurance Company, Wilkes-Barre, Pa.	1,252	Ark., D.C., Fla., Ga., Ind., Kans., Ky., Me., Mass., Mo., N.H., N.J., N.Y., N.C., Ohio, Pa., R.I., S.C., Tenn., Vt., Va.	PA.—D.C.
Pennsylvania National Mutual Casualty Insurance Company, Harrisburg, Pa.	2,678	All except Cal., C.Z., Conn., Guam, Hawaii, Me., Mass., Nev., N.H., N.Y., N.Dak., Puerto Rico, Virgin Islands, Wyo.	PA.—D.C., Kans., Md., Mo., N.J., N.C., Okla., Tenn., Va.
Phoenix Assurance Company of New York, New York, N.Y.	1,881	All except C.Z., Guam	N.Y.—All except Alaska, C.Z., Guam, Puerto Rico, Virgin Islands.
The Phoenix Insurance Company, Hartford, Conn.	6,478	All except C.Z., Guam, Puerto Rico	CONNAll except C.Z., Guam, Puerto Rico, Virgin Islands.
Planet Insurance Company, Philadelphia, Pa.	575	All except C.Z., Conn., Guam, Hawaii, Md., Mich., Puerto Rico, Virgin Islands.	WIS.—All except C.Z., Guam, Virgin Islands.
Potomac Insurance Company, Philadelphia, Pa.	9,442	All except Alaska, Ark., C.Z., Del., Guam, Hawaii, Idaho, Me., Mont., Nev., N.H., N.Dak., Puerto Rico, S.Dak., Vt., Virgin Islanda.	PA.—All except Ala., Alaska, Ark., C.Z., Del., Guam, Hawaii, Idaho, Me., Mont., Nev., N.H., N.Dak., Oreg., Puerto Rico, S.Dak., Vt., Virgin Islands.
Progressive Casualty Insurance Company, Mayfield Village, Ohio	1,294	All except Ariz., C.Z., Conn., Del., D.C., Guam, Eswaii, Ill., Kans., La., Mi., Nebr., N.H., N.Y., Pa., Puerto Rico, S.C., Tex., Utah, Va., Virgin Islands, W. Va., Wis.	OHIO—D.C.
The Progressive Mutual Insurance Company, Mayfield Village, Ohio	374	N.J., Ohio	оню—р.с.
Protective Insurance Company, Indianapolis, Ind.	1,307	All except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.	IND, -D.C.

\*See footnotes at end of table.

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorporated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Public Service Mutual Insurance Company, New York, N.Y.	2,551	Conn., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Me., Nd., Mass., Mich., Minn., N.H., N.J., N.Y., N.C., Pa., R.I., Vt., Va., W. Va., Wis.	N.YD.C., sFla., N.J., ePa., wTex.
Puerto Rican-American Insurance Company, San Juan, Puerto Rico	797	Puerto Rico, Virgin Islands	PUERTO RICO-D C.
The Reinsurance Corporation of Hew York, New York, N.Y.	2,294	All except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands. (Co-surety only in Fla., Mass., Va.)	N.Y.—D.C.
Reliance Insurance Company, Philadelphia, Pa.	10,791	All except Guan	PA.—All.
Republic Insurance Company, Dallas, Tex.	3,677	All except Ala., C.Z., Fla., Guam, Hawaii, Me., Mass., Mont., N.H., N.Dak., R.I., S.Dak., Vt., Virgin Islands.	TEX.—D.C.
Reserve Insurance Company, Chicago, Ill.	887	All except C.Z., Conn., Guam, N.Y., Puerto Rico.	ILL.—All except C.Z., Conn., Guam, Hawaii, N.Y., Puerto Rico, Virgin Islands.
Resolute Insurance Company, Hartford, Conn.	342	All except C.Z., Guam., Kans., La., N.Y., Puerto Rico, Virgin Islands.	R.I.—All except wArk., C.Z., mGa., Guam, Hawaii, La., Me., wMich., nMiss., nwN.Y., N.C., Oreg., Puerto Rico, S.C., S.Dak., weTenn., Utah, Vt., wVa., Virgin Islands, nW.Va.
Royal Globe Insurance Company, New York, N.Y.	3,121	All except C.Z., D.C., Guam, Puerto Rico, Virgin Islands.	ILLD.C., N.C., S.C., Va.
Royal Indemnity Company, New York, N.Y.	3,108	All	N.Y.—All except Guam, Virgin Islands.
S & H Insurance Company, Los Angeles, Cal. 4*	449	Cal.	CAL.—D.C.
Safeco Insurance Company of America, Seattle, Wash.	- 4,446	All except C.Z., Puerto Rico, Vt.	WASH.—All except C.Z., Puerto Rico, Virgin Islands.
Safeguard Insurance Company, New York, N.Y.	838	All except C.Z., Del., Quam, Puerto Rico, Virgin Islands.	CONN.—All except C.Z., Guam, nMiss., wOkla., Puerto Rico, Virgin Islands W. Va.
St. Paul Fire and Marine Insurance Company, St. Paul, Minn.	10,232	All except C.Z., Gues	MINN, All except Guam.
Seaboard Surety Company, New York, N.Y.	2,632	A11	N.Y.—All.
Security Insurance Company of Hartford, Hartford, Conn.	1,809	All except C.Z., Guam, Virgin Islands-	CONN.—All except Alaska, esCal., C.Z., Guam, Hawaii, seIll., sIowa, eTenn., Virgin Islands, eWash., sW. Va.
Security Mutual Casualty Company, Chicago, Ill.	471	All except Alaska, C.Z., Conn., Guam, Hawaii, Puerto Rico, S.C., Virgin Islands.	ILL.—D.C.
Security National Insurance Company, Dallas, Tex.	465	Ala., Cal., Colo., Fla., Ga., Ill., Ind., Kans., Ky., Minn., N.Mex., N.Dak., Ohio, Okla., S.Dak., Tex., Wash., Wis., Wyo.	TEXAll except C.Z., Guam, Mont.
Select Insurance Company, Dallas, Tex,	775	All except Ariz., C.Z., Conn., Del., Guam, Hawaii, La., He., Hd., Hass., N.H., N.Y., N.Dak., Pa., Puerto Rico, R.I., Tenn., Utah, Va., Virgin Islands.	TEX.—All except C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
Selected Risks Insurance Company, Branchyille, N.J.	1,694	Del., Md., N.J., Pa., Va., Wash.	N.J.—Del., D.C., Md., Pa., Va.
Sentry Indemnity Company, Steyens Point, Wis.	832	All except Alaska, C.Z., Conn., Del., D.C., Guam, Hawaii, Kans., Me., Mass., Mich., Nebr., N.H., N.J., N.Y., Pa., Puerto Rico, R.I., Vt., Va., Virgin Islands, W.Va., Wyo.	WIS.—Cal., D.C., msFla., eLa., eVa., wWash.
Sentry Insurance a Nutual Company, Steyena Point, Wis.	6,083	All except C.Z., Guam, Virgin Islands.	WIS.—Cal., D.C., msFla., nGa., nIII., eLa., Me., Mass., Mich., sN.Y., sTex. wWash.
Signal Insurance Company, Los Angeles, Cal.	355	Ariz., Cal., Fla., Ga., Iowa, Mont., Nev., H.Mex., N.C., H.Dak., Oreg., Utah, Wash.	CALD.C., Ga., Idaho, Nev., Oreg.

<sup>\*</sup>See footnotes at end of table

Names of companies and locations of principal executive offices	Underwriting limitations (net_limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorporated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
Standia America Reinsurance Corporation, New York, N.Y. 5*	2,327	Cal., Ga., Ill., Ind., Iowa, Mich., #,J., N.Y., Ohio, Pa., Utah. (Reinsurance only in D.C., Kans., Okla., Tax., W. Va.).	N.Y.—
South Carolina Insurance Company, Columbia, S.C.	807	Ala., Alaska, Ariz., Cal., Colo., D.C., Fla., Ga., Ill., Ind., Iowa., Kans., Ky., Kd., Mich., Minn., Miss., Mo., Mont., Nebr., Hev., N. Mex., N.Y., N.C., R.Dak., Ohio, Okla., Pa., R.I., S.C., S.Dak., Tenn., Tex., Utah, Va., Wis. (Reinsurance only in Comm., N.J., W.Va.)	S.C.—nmAla., D.C., Fla., Ga., N.C., Va.
The Standard Fire Insurance Company, Hartford, Conn.	1,900	All except C.Z., Guam, N.J., Puerto Rico, Virgin Islands.	CONN.—All.
State Automobile Mutual Insurance Company, Columbus, Ohio	3,934	Ala., Fla., Ga., Ill., Ind., Ky., Md., Mich., Miss., Mo., N.J., N.C., Ohio, Pa., S.C., Tenn., Va., W.Va.	OHIO-Ala., D.C., Fla., Ga., Ky., Md., Mich., Miss., eMo., N.C., Pa., S.C., Tenn., Va., W.Va.
State Farm Fire and Casualty Company, Bloomington, Ill.	22,700	All except C.Z., Guam, Puerto Rico, Virgin Islands.	HLL.—Ariz., cCal., Colo., D.C., mGa., Md., Minn., nMiss., Mont., N.J., eN.Y., wOkla., mPa., sTex., Utah.
State Surety Company, Des Moines, Iowa	99	Colo., D.C., Iowa, Kans., Minn., Mo., Mont., Nebr., N.Dak., S. Dak., Wis., Wyo.	IOWA.—eArk., Colo., D.C., sFla., Ill., Kans., eLa., wMich., Minn., sMiss., Mô., Nebr., sN.Y., N.Dak., nOhio, wnOkla., S.Dak.
Statesman Insurance Company, Indianapolis, Ind.	278	Ala., D.C., Fla., Ga., Ill., Ind., Iowa, Kans., Ky., La., Md., Minn., Miss., Mont., N.Mex., H.Dak., Pa., S.Dak., Tenn.	IND.—Ariz., nceCal., Colo., D.C., III. nIowa, Kans., La., Minn., Mo., Mont., Nebr., N. Mex., N. Dak., Okla., wmPa., S.Dak., Tex., Wyo.
The Stuyvesant Insurance Company, Allentown, Pa.	250	All except C.Z., Guam, Virgin Islands-	N.Y.—All except Alaska, C.Z., Guam, Hawaii, Virgin Islands.
Sum Insurance Company of New York, New York, N.Y.	813	All except Ala., Alaska, Ariz., Ark., C.Z., Colo., Fla., Ga., Guam, Hawaii, Idaho, Ind., Kans., Miss., Nebr., Nev., N.C., N.Dak., Puerto Rico, S.C., S.Dak., Utah, Virgin Islands, W.Va.	N.Y.—All except Alaska, C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
Surety Company of the Pacific, Los Angeles, Cal.	71	Cal.	CAL.—D.C.
Surety Insurance Company of California, La Habra, Cal.	59 .	Alaska, Cal., Colo., N.Max., Tex.	CAL.—Alaska, Colo., D.C., N.Mex., Tex.
Transamerica Insurance Company, Los Angeles, Cal.	6,311	All except Guam	CAL.—All except C.Z., Guam, Virgin Islands.
Transcontinental Insurance Company, Chicago, Ill.	2,136	All except C.Z., Guam, Hawaii, Virgin Islands	N.Y.—All except C.Z., Guam, Virgin Islands.
Transport Indemnity Company, Los Angeles, Cal.	787	All except C.Z., Guam, Virgin Islands	CAL.—All except Alaska, C.Z., Gusm, eKy., eLa., Nev., nwN.Y., eOkla., Puerto Rico, mTenn., wVa., Virgin Islands, nW.Va.
Transportation Insurance Company, Chicago, Ill.	1,163	All except C.Z., Guam, Puerto Rico, Virgin Islands.	ILL.—All except C.Z., Guam, wN.Y., Puerto Rico, S.Dak., Virgin Islands.
The Travelers Indemnity Company, Hartford, Conn.	19,577	A11	CONN All except Guam.
The Travelers Indemnity Company of Rhode Island, Hartford, Conn.	2,362	All except C.Z., Guam-	R.I.—All except C.Z., Guam, eIll., who., Puerto Rico, Virgin Islands.
Trinity Universal Insurance Company, Dallas, Tex.	3,993	All except Alaska, C.Z., Conn., Del., Guam, Hawaii, Me., Md., Mass., Mont., Nev., N.H., N.J., N.Y., Puerto Rico, R.I., S.C., Tenn., Utah, Vt., Va., Virgin Islands, W.Va.	TEX.—All except Guam.
Tri-State Insurance Company, Tulsa, Okla.	529	All except Alaska, Cal., C.Z., Conn., Del., D.C., Guam, Hawaii, Me., Md., Mass., Mich., Nev., N.H., N.J., N.Y., N.C., Ohio, Oreg., Pa., Puerto Rico, R.I., S.C., Vt., Va., Virgin Islands, W.Va., Wis.	OKIA.—All except Alaska, Cal., C.Z., Conn., Del., Guam, Hawaii, Me., Md., Mass., Mich., Nev., N.H., N.J., N.Y., N.C., Ohio, Oreg., Pa., Puerto Rico, R.I., S.C., Vt.; Va., Virgin Islanda, W.Va., Wis.

Names of companies and locations of principal executive offices	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	States and other areas in which licensed to transact surety business. [See note (c)]	State or other area in which incorpo- rated (in capitals), and judicial districts in which process agents have been appointed (letters preceding names of States indicate judicial districts). [See note (d)]
		4	
Twin City Fire Insurance Company, Hartford, Coun.	858	All except C.Z., Guan, Puerto Rico, Virgin	MINN.—scCal., Conn., D.C., La., Va.
United Fire & Casualty Company, Cedar Rapids, Iowa	581	Aris., Colo., Ill., Ind., Iowa, Minn., Ho., Mont., Nebr., N.Y., N. Dak., S. Dak., Wis., Wyo.	IOWA-D.C., neIll., Minn., Mo., Nebr., S. Dak., Wis.
United Pacific Insurance Company, Philadelphia, Pa.	4,428	All except C.Z., Guam, Puerto Rico, Virgin Islands.	WASH.—All except C.Z., Puerto Rico, Virgin Islands.
United States Fidelity and Guaranty Company, Baltimore, Hd.	25,081	All except Guem	MD.—All except Guam.
United States Fire Insurance Company, Morristown, N.J.	7,687	All except C.Z., Guam.	N.YAll except Alaska, C.Z., Guam, Hawaii, Virgin Islands.
Universal Surety Company, Lincoln, Hebr.	243 -	Arix., Colo., Ill., Iowa., Kans., Minn., Mo., Nont., Nebr., H.Mex., N.Dak., Ohio, Okla., S.Dak., Utah, Wash., Wis., Wyo.	NEBR.—Ariz., eArk., Colo., D.C., nIII. Iowa, Kans., Minn., Mo., Mont., N.Mex. N.Dak., nOhio, wOkla., S.Dak., Utah, wWis., Wyo.
Utica Hutual Insurance Company, Utica, N.Y.	2,748	All except C.2., Guam, Kans., Virgin Islands.	N.Y.—All excpt Alaska, C.Z., Guam, Hawaii, He., Puerto Rico, Virgin Islands.
Valley Forge Insurance Company, 6 Chicago, Ill.	1,117	All except Alaska, C.Z., Guam, Rawaii, Puerto Rico, Virgin Islands.	PA.—All except Guam, Virgin Islands.
Vigilant Insurance Company, New York, N.Y.	2,163	Ala. (except official), Ariz., Ark., Cal., Colo., Conn., Del., D.C., Fla., Ga., Idaho, Ill., Ind., Iowa, Kms., Ky., La., Me., Md., Hass., Mich., Minn., Mise., Mo., Mont., Nebr., Nev., N.H., H.J., H.Mex., N.Y., N.C., N.Dak., Ohio, Okla., Oreg., Pa., R.I., S.C., S.Dak., Tenn., Tex., Utah, Vt., Va., Virgin Islands, Wach., W.Va., Wis., Wyo.	N.Y.—All except Alaska, Guam, Hawaii, Puerto Rico, Virgin Islands.
West American Insurance Company, Hamilton, Ohio	3,282	All except Alaska, C.Z., Conn., Guam, Hawaii, Me., Mass., Mont., N.H., Puerto Rico, R.I., Vr., Virgin Islands, W.Va.	CAL.—Ala., Colo., D.C., nsFla., Ga., Ill., Ind., Iowa, Kans., Ky., eLa., Md., Mich., Minn., Mo., Nev., N.Mex., N.Dak., Ohio, nokla., Oreg., Pa., mTenn., Tex., Utah, Va., Wash., Wis., Wyo.
Westchester Fire Insurance Company,	3,212	All except C.Z., Guam, Virgin Islands.	N.YAll except Alaska, C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
Horristown, W.J.  The Western Casualty and Surety Company, Fort Scott, Kans.	7,303	All except C.Z., Conn., Guam, Hawaii, Me., Hass., N.H., M.Y., Puerto Rico, Vt., Va., Virgin Islands.	KANS.—All except Guam, Puerto Rico, Virgin Islands.
The Western Fire Insurance Company, Fort Scott, Kans.	4,779	All except C.Z., Conn., Del., D.C., Ga., Guam, Hawaii, Idaho, La., Me., Md., Mass., Mont., N.H., N.J., Oreg., Puerto Rico, S.C., Tex., Vt., Va., Virgin Islands, W.Va.	Kans.—All except Guam, Puerto Rico, Virgin Islands.
Western Surety Company, Sioux Falls, S. Dak.	1,681	All except Alaska, C.Z., Guam, Hawaii, N.Y., Puerto Rico, Virgin Islands.	S.DAK All except Alaska, C.Z., Guam, Hawaii, Fuerte Rico, Virgin Islands.
Westfield Insurance Company, Westfield Center, Ohio	1,358	All except Ala., Alaska, Ark., C.Z., Conn., Fla., Ga., Guan, Hawaii, La., Me., Kiss., Mo., N.H., N.Mex., Fuerto Rico, Virgin Islands.	OHIO-All except Alaska, C.Z., Guam, Hawaii, Puerto Rico, Virgin Islands.
Wilshire Insurance Company, Los Angeles, Cal.	293	Ariz., Cal., Colo., Hawafi, Idaho, Iowa, Mont., Nev., N.Mex., Oreg., S.Dak., Utah, Wash.	CALD.C., Idaho, Mont., N.Mex., Oreg., wWash.
Wolverine Insurance Company, Battle Creek, Mich.	2,579	Ark., Cal., Ga., Ill., Ind., Iowa, Kans., Hich., Minn., Rebr., N. Hex., N.Dak., Ohio, Pa., S.Dak., Vt., W. Va., Wyo.	MICH D.C., Ga., Ill., Ind., Iowa, Minn., Ohio, S.Dak.

<sup>\*</sup>See footnotes at end of table.

COMPANIES HOLDING CERTIFICATES OF AUTHORITY FROM THE SECRETARY OF THE TREASURY AS ACCEPTABLE REINSURING COMPANIES UNDER TREASURY CIRCULAR NO. 297, REVISED FEBRUARY 10, 1975 [See Note (a)]

Names of companies	Underwriting limitations (net limit on any one risk) in thousands of dollars. [See note (b)]	Judicial districts in which process agents have been appointed
cident and Casualty Insurance Company of Winterthur, Switzerland (U.S. Office, New York, N.Y.)		
liance Assurance Company, Limited, London, England (U.S. Office, New York, N.Y.)	1,172	D.C.
mstellation Reinsurance Company, New York, N.Y.	1,764	D.C. D.C.
meral Accident Fire and Life Assurance Corporation, Limited, Perth, Scotland (U.S. Office.	1,704	D.C.
Philadelphia, Pa.)	20,650	D.C.
e London Assurance, London, England (U.S. Office, New York, N.Y.)	• 648	D.C.
e London & Lancashire Insurance Company, Limited, London, England (U.S. Office, New York, N.Y.)	530	D.C.
tropolitan Fire Assurance Company, Hartford, Conn.	475	D.C.
nich Reinsurance Company, Munich, Germany (U.S. Office, New York, N.Y.)	1,864	D.C.
Netherlands Insurance Company, Est. 1845, The Hague, Holland (U.S. Office, Keene, N.H.)	486	D.C.
chdale Insurance Company, New York, N.Y.	270	D.C.
al Insurance Company, Limited, Liverpool, England (U.S. Office, New York, N.Y.)	1,588	D.C.
Sea Insurance Company, Limited, Liverpool, England (U.S. Office, New York, N.Y.)	479	D.C.
Insurance Office, Limited, Loudon, England (U.S. Office, New York, N.Y.)	787	D.C.
iss Reinsurance Company, Zurich, Switzerland (U.S. Office, New York, N.Y.)	2,194	D.C.
rich Insurance Company, Zurich, Switzerland (U.S. Office, Chicago, III.)	3,846	D.C.

#### FOOTNOTES

- 1/ Houston General Insurance Company, Fort Worth, Tex. -- changed its name to Equitable General Insurance Company
- 2/ Traders & General Insurance Company, Fort Worth, Tex. -- changed its name to Houston General Insurance Company
- 3/ The Frudential Insurance Company of Great Britain Located in New York, New York, N.Y. -- changed its name to The Mercantile and General Reinsurance Company of America (see Federal Register of May 19, 1975, pg. 21744)
- 4/ Martin Insurance Company, Los Angeles, Cal. -- changed its name to S & H Insurance Company (see Federal Register of April 24, 1975, pg. 18008)
- 5/ The Skandia Insurance Company, Stockholm, Sweden (U.S. Office, New York, N.Y.) domesticated and is now known as Skandia America Reinsurance Corporation (see Federal Register of November 19, 1974, pg. 40592)

#### NOTES

- (a) All certificates of authority expire June 30, and are renewable July 1, annually. Companies holding certificates of authority as acceptable sureties on Federal bonds are also acceptable as reinsuring companies.
- (b) Figures are given in thousands of dollars: last "ooo" omitted. Treasury requirements do not limit the penal sum of bonds which surety companies may execute. The net retention, however, cannot exceed the underwriting limitation, and excess risks must be protected by coinsurance, reinsurance, or other methods in accordance with Treasury Circular 297, Revised February 10, 1975 (31 CFR § 223.10, § 223.11). When excess risks on bonds in favor of the United States are protected by reinsurance, such reinsurance is to be effected by use of a Treasury reinsurance form to be filed with the bond or within 45 days thereafter. Risks in excess of limit fixed herein must be reported for quarter in which they are executed. In protecting such excess, the rating in force on the date of the execution of the risk will govern absolutely. This limit applies until a new rating is established by the Treasury Department.
- (c) A surety company must be licensed in the State or other area in which it executes (signs) a bond, but need not be licensed in the State or other area in which the principal resides or where the contract is to be performed [28 Op. Atty. Gen. 127, Dec. 24, 1909; 31 CFR § 223.5(b)]. The term "other areas" includes the Canal Zone, District of Columbia, Guam, Puerto Rico, and the Virgin Islands.
- (d) State or other area in which company is incorporated shown in capitals. Process agents are required in the following districts: Where principal resides; where obligation is to be performed; and in the District of Columbia where the bond is returnable or filed. No process agent is required in the State or other area wherein the company is incorporated (31 CFR \$224.2). Letters "n, s, e, m, c, and w" preceding names of States indicate respectively the Northern, Southern, Eastern, Middle, Central, and Western judicial districts of States indicated. If letters do not precede names of States, process agents have been appointed in all judicial districts of such States.

[FR Doc.75-17664 Filed 7-9-75;8:45 am]

Bonding Componen



Queen of Ment Meetings



#### AGENDA FOR DIRECTOR'S SAN FRANCISCO CONFERENCE SEFTEMBER, 1973

	Topic	Pr	esenter
1	Report on Items requiring action from April, 1973 Director's Conference:  a. Standardization of equipment smong field office.  b. Elimination of coin feeder mechanism	۸.	Goldman
L	profiem.	A.	Goldman
t	c. Clearly defined procedures for coin sampling. Need for improved coin projections. e. Hint-wide production meeting.	R.	Goldman Cahoon Ambrose
2.	Report to Director and staff on outcome		
V	of AFGE election and forthcoming contract	P.	Brawner
A.	Implementation of EEO program.	E.	Hinson
40	Security improvements resulting from Secret Service reports.	J.	McGee
5	Current budget status, reviews, and hearings; the effect of the continuing resolution on manning levels and funding.	B.	Frere
6.	Congressional action on our impact state- ment relative to \$1.5 million cut in 1974		
	budget.	B.	Frere
1.	The importance of maintaining financial plans reflecting current production assignments.		Frere Ambrose
8.	Status of Denver Hint and West Point opera- tions.		Ehes Hackmald
9,	Intern and executive development programs; policy for employee education.	B.	Tingley

	,		
10/	Management improvement programs.	в.	Frere
W	Paperwork management.	В.	Frere
12.	Organization and mission of Old Mint.	к.	Conner
A.	Discussion of numismatic order processing and mailing problems.	J.	Scott
	1		
14/	Reimbursable programs, potential and pre- sent; where they are to be accomplished; order processing and liaison functions.		Cahoon Ambrose
15/	Coordination of Mint's public information program.	R.	Cahoon
16.	Proposed new coinage for Bicentennial and status of associated legislation.		Cahoon Lonkay
17/.	Minor coinage metals and denomination study, and its potential impact.	A.	Goldman
18.	Domestic coinsge forecast through 1980; methods to meet demand; and impact of Bicen- tennial coinage.	G.	Ambrose
19/	Resident auditor program.	W.	Rumbert
20/	Proposed changes in settlement procedures.	W.	Humbert
21.	Long-range plans for computer utilization.		Frere Stretton

E

#### ATTENDEES - DIRECTOR'S CONFERENCE

#### SAN FRANCISCO, 1973

- M. Brooks
- F. MacDonald
- J. Alliston
- G. Ambrose
- A. Bresnick
- B. Frere
- R. Cahoon
- D. Duke
- K. Conner
- J. Scott
- J G. Stratton
  - A. Goldman
  - E. Hinson
  - M. Lonkay
  - W. Humbert
  - J. McGee
  - F. Rhea
  - G. Pierce
  - G. Sparks
  - E. Shaw
  - F. Tingley
  - P. Brawner
  - G. Ohliger

- R. Rhyne
- B. Brockenborough
- G. Wright
- R. VOBB
  - A. Friedman
  - M. Harriman
  - N. Costango
  - J. Nugent
- F. Lisi
- F. Papa
- V. Harkin
- B. Higby
- H. Lawrence
- W. Darlington
- N. Theodore
- S. Rosenbaum
- J. Carroll

Why 15 Roy Involved in

don't # 1c (oin projection?

He's our contact with all outside organization (Four gotts, stee bupt, Fed)

[in not one this is a very good idea.]

1

Nearly all people her, In were not developed by the Buran of the mint Director's Conference - San Francisco - Sept. 1973

#### Budget Presentation

#### A. Overview

Description of Budget process from original request to approval of Budget by Congress. FY 74 used as guide.

## B. Mint Budget FY 1974 - Actions Taken - Direct Program

Status of FY 1974

- 1. Requested of Treasury Long-Range April 6, 1972 \$26,846,000
- 2. Budget presentation to Treasury
  September 29, 1972 \$26,846,000
- 3. Presented to OMB
  October 11, 1972 \$25,784,000
- 4. Submitted to Congress. Hearing in House March 1973 Requested \$24,5000,000 Approved \$23,750,000
- 5. Hearing in Senate

May 1973 Requested \$23,750,000 Approved \$23,000,000

6. Present status of Appropriation Bill.

Mint accepted the House cut, and appealed the Senate cut to Treasury. Conference Committee informally advised of our tight situation. Conference Committee has not yet acted.

### C. Operating Status of Funds

1. Continuing resolution permits us to operate at same level as last year.

Last year's budgetAdd: Pay raises supplemental covering	\$23,000,000
FY 1973 pay raises	1,600,000
Base under continuing resolution	24,600,000
Less: Equipment Funds	_2,400,000
Funds available for allocation	22,200,000
Divided by 4 quarters gives the amount	
available by quarters	
	allocation

## 2. FY 1974 Budget at present:

Requested from Congress	24,500,000
Cut by House	(750,000)
Cut by Senate	(750,000)
Department advised Bureau to use Supp. Pay Act	to
cover 1973 pay raise in our Planning. Supp. won'	
be requested until late FY 1974	1,600,000
Best picture of available funds	24,600,000
Less Equipment	2,400,000
Funds available for Personnel and othersame \$	22,200,000
level as currently operating	

#### PROPOSED CHANGES IN SETTLEMENT PROCEDURES

During the July conference in Philadelphia, the subject of updating and streamlining the annual settlements was discussed. Proposals were made to use the resident internal auditors to perform preliminary verification work to shorten the settlement period. Accordingly, the following proposals are offered for discussion.

by the internal auditors and representatives of the institution to certify the contents of vault compartments, bins and storage tanks at all Mint institutions, and vault cages at the Philadelphia Mint. This seal would be of a lower classification than the Official Joint Seal which is affixed only to invulnerable vault compartments by an Official Joint Sealing Committee. The resident internal auditors and institution representatives would affix the temporary seals sometime prior to settlement when it has been determined that removal of the items before settlement is unlikely.

The seal would be acceptable to the settlement committee for annual settlement purposes. However, the seal could be removed and the contents under seal could be verified at the discretion of the settlement committee chairman.

The seal would be similar in appearance and have features similar to the Institution Seal but would differ in the respect that verification of the contents by the resident internal auditors would be performed under procedures similar to those used for official joint sealing. In addition, it would add the feature of an independent check on behalf of the settlement committee by persons representing the Director's Office.

- 2. The resident auditors can make periodic inventory checks during the year of material stored at points outside the Mint institutions. Certification of the quantities of the material stored could be acceptable by the committees without further verification. In this way the committees would be relieved of the need to visit such storage points.
- 3. The resident internal auditors can perform mathematical verification of schedules of materials prior to settlement for the settlement committees, <u>IF</u> the institutions can arrange to have the schedules prepared a week or two in advance of settlement. This has always been a problem at certain locations.

# SPECIAL COINAGE AND MEDALS PROGRAMS FOR CALENDAR YEAR 1974

	Pro	ogram	Order Acceptance Period
1.	1974	Proof Coin Sets	November and December, 1973
2.	1974	Uncirculated Coin Sets	January and February
3.	1974	America's First Medals (Washington Before Boston & Maj. Gen. Gates, for Saratoga)	February and March
4.	1974	Proof Eisenhower Dollar	April and May
5.	1974	ARBC - PNC	July
6.	1974	Penny Bags	July and August
7.	1974	Uncirculated Eisenhower Dollar	August and September
8.	1974	ARBC - Unique Package-Bronze Silver	October October
9.	List	Medals	Continuous

#### SALES OUTLETS FOR NUMISMATIC ITEMS

#### BUREAU OF THE MINT

MAIN TREASURY
PHILADELPHIA MINT
DENVER MINT
SAN FRANCISCO MINT

#### OTHER AUTHORIZED INSTITUTIONS

U. S. CAPITOL HISTORICAL SOCIETY DWIGHT EISENHOWER LIBRARY HARRY TRUMAN LIBRARY LYNDON JOHNSON LIBRARY HERBERT HOOVER LIBRARY FRANKLIN ROOSEVELT LIBRARY JOHN F. KENNEDY CENTER GOVERNMENT SERVICES, INC. STARK COUNTY HISTORICAL SOCIETY LYNDON B. JOHNSON NATIONAL HISTORIC SITE FORT CLATSOP HISTORICAL SOCIETY CALVIN COOLIDGE MEMORIAL FOUNDATION PATTON MUSEUM U. S. FRIGATE CONSTELLATION MINORITY CONCESSIONS THE FREEDOM TRAIL

ITEM	COST	AVG # SETS/ORDER	AVG \$ VALUE/ORDER	TOTAL	SALES (TOTAL SETS)	SALES (TOTAL \$)	ORDER ACCEPTANCE PERIOD
1971 Proof Sets	5.00	3.839	19.20	838,936	3,220,733	16,103,665	11-1-71to 12-31-71
1971 Unc. Sets	3.50	3.544	12.40	618,624	2,192,844	7,674,954	3-1-71to 4-15-71
1971 Proof Ike	10.00	2.962	29.62	1,435,168	4,255,966	42,559,660	7-1-71to 10-8- 71
1971 Unc. Ike	3.00	3.563	10.69	1,833,332	6,532,770	19,598,310	7-1-71to 10-8-71
1972 Proof Sets	5.00	3.394	16.97	960,713	3,260,996	16,304,980	11-1-71to 12-31-71
1972 Unc. Sets	3.50	3.124	10.93	862,838	2,696,197	9,436,689	2-1-72to 3-15-72
1972 Proof Ike	10.00	2.695	26.95	659,598	1,778,112	17,781,120	5-1-72to 7-15-72
1972 Unc. Ike	3.00	3.327	9.98	656,853	2,185,586	6,556,758	8-1-72to 10-16-72
1972 PNC	5.00	1.939	9.70	407,687	790,726	3,953,630	7-1-72to 8-31-72
1972 Penny Bags	.40Mail 25_OTC	12.762	5.10	29,130	371,820	148,728	1-15-73to 2-15-73
* 1973 Proof Sets	7.00	2.886	20.20	956,451	2,760,339	19,322,373	11-1-72 to 2-28-73
* 1973 Unc. Sets	6.00	2,689	16.13	657,400	1,767,691	10,606,146	2-1-73 to 4-15-73
* 1973 Proof Ike	10.00	2.381	23.81	412,048	980,039	9,800,390	5-1-73 to 7-15-73
* 1973 Unc. Ike	3.00	3.274	9.82	452,053	1,483,086	4,449,258	8-1-73 to ?
* 1973 PNC	5.00	1.792	8.96	261,184	468,069	2,340,345	7-4-73 to 7/31/73
* 1973 Penny Bags	.40Mail .25OTC	12.760	5.10	14,427	184,090	73,636	July & August, 1973
* as of 9-10-73				,			

#### ACTIVITY IN NUMISMATIC SETS AND MEDALS

#### CALENDAR YEAR

	I	d C	T U	A	L	EST	IMATED
	1968	1969	1970	1971	1972	1973	1974
PROOF COIN SETS	3,000,000	2,900,000	2,600,000	3,200,000	3,300,000	Actual 2,800,000	3,000,000
UNCIRCULATED COIN SETS	2,100,000	1,800,000	2,000,000	2,200,000	2,700,000	Actual 1,700,000	2,000,000
PROOF EISENHOWER DOLLAR				4,300,000	1,800,000	Actual 1,000,000	1,300,000
· UNCIRCULATED EISENHOWER DOLLAR				6,500,000	2,200,000	Actual 1,600,000	1,900,000
ARBC (PNC)					800,000	Actual 500,000	800,000
ARBC UNIQUE PACKAGE (S-Silver, B-Bronze)					700,000	S- 200,000 B- 600,000	s- 400,000
PENNY BAGS					400,000	Actual 300,000	
	E S	Т	I M	A	T E	D	
LIST MEDALS	30,083	60,111	150,213	586,363	748,900	1,000,000	1,200,000

OFFICE OF PUBLIC SERVICES BUREAU OF THE MINT

<sup>\*</sup>The above figures are rounded off to the nearest 100,000

#### PROOF COIN SETS

YEAR	SELLING PRICE	FACE VALUE	NUMBER OF RECEIVED	ORDERS	NUMBER OF SETS PRODUCED
1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967	No proof	.91 .91 .91 .91 .91 .91 .91 .91 .91 .91	made made		51,386 57,500 81,980 128,800 233,350 378,200 669,384 1,247,952 875,652 1,149,291 1,691,602 3,028,244 3,218,019 3,075,645 3,950,762
1968 1969 1970 1971 1972 1973	5.00 5.00 5.00 5.00 5.00 7.00	.91 .91 .91 .91 .91	491,287 294,000 787,000 838,936 960,713 955,704		3,041,506 2,934,631 2,632,810 3,224,138 3,267,667

## UNCIRCULATED COIN SETS

YEAR	SELLING PRICE	FACE VALUE	NUMBER OF ORDERS RECEIVED	NUMBER OF SETS PRODUCED
1947 1948 1949 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1963 1964 1966 1966 1967 1968 1969 1971 1972 1973	6.75 6.14 6.14 6.19 3.57 3.34 4.40 4.43 2.40 2.40 2.40 2.40 2.40 2.50 2.50 2.50 2.50 2.50 3.50	Mint Sets Mint Sets 1.33 1.33 1.33 1.83 1.83	75,297 103,507 241,898 350,547 488,256 566,522 618,624 862,886	12,600 17,000 20,739 8,654 11,499 15,538 25,599 49,656 45,475 32,324 50,314 187,000 260,485 223,704 385,285 605,612 1,008,108 2,360,000 2,261,583 1,863,344 2,105,128 1,817,392 2,038,134 2,193,396 2,750,000
-713	6.00	3.83	657,400	

OFFICE OF PUBLIC SERVICES BUREAU OF THE MINT

<sup>\*</sup>Accountability transferred to the Mint per DOT 179-3 dated October 16, 1961

PROOF EISENHOWER SILVER DOLLAR

YEAR	SELLING PRICE	FACE VALUE	NUMBER OF ORDERS RECEIVED	NUMBER OF COINS PRODUCED
1971	\$10.00	\$1.00	1,435,168	4,265,234
1972	\$10.00	\$1.00	659,598	1,811,631
1973	\$10.00	\$1.00	412,048	

# UNCIRCULATED EISENHOWER SILVER DOLLAR

1971	\$ 3.00	\$1.00	1,833,332	6,668,526
1972	\$ 3.00	\$1.00	656,862	2,371,060
1973	\$ 3.00	\$1.00	478,553 as of 9/12	

# AMERICAN REVOLUTION BICENTENNIAL COMMISSION Philatelic-Numismatic Commemorative (PNC)

YEAR	ORDERS	NUMBER OF UNITS	DOLLARS
1972	407,687	790,726	\$3,953,630.00
1973	261,184	468,069	\$2,340,349.26
	Single	Medal In Case (Unique)	
1972	313,883	667,149	\$2,335,021.50

## MEDAL SALES FOR FISCAL AND CALENDAR YEAR 1972

### (Approximate Number)

Walata	Fiscal	Year	Calendar Year		
Medals	Amount	Number	Amount	Number	
Presidential	\$119,075.25	24,000	\$129,998.25	26,000	
Secretaries of the Treasury	8,025.50	1,600	8,492.50	1,700	
Directors of the Mint	2,069.00	400	2,456.25	500	
Army	10,232.00	1,700	11,769.00	2,000	
Navy	11,177.25	1,900	13,954.50	2,300	
Miscellaneous	47,029.57	7,800	50,573.07	8,400	
Medals of the U.S. Mints	48,931.06	97,800	67,274.80	135,000	
Miniature Presidential Series	187,066.70	375,000	193,514.90	387,000	
Gold Plated Miniature Presidential Series	67,565.50	18,000	88,544.50	24,000	
Medal Sales to Presidential Libraries and Historical Sites	\$ =63,674.63	160,000	\$ 64,855.50	162,000	
Totals	\$564,846.46	*688,200	\$631,433.29	*748,900	

<sup>\*</sup> Thère were 208,400 other congressionally approved medals sold to sponsoring organizations.

OFFICE OF PUBLIC SERVICES BUREAU OF THE MINT

## NUMBER OF MEDALS SOLD DURING FISCAL YEARS 1965 - 1972

Fiscal Year	Number	of Medals	Sold
1965		141,166	
1966		69,799	
1967		24,577	
1968		71,180	
1969		348,100	
1970		101,500	
1971		480,700	
1972		896,678	
	Total 2	,133,700	

#### OTHER GOVERNMENT AGENCY MEDALS

U. S. ARMY

U. S. NAVY

U. S. MARINE CORPS

U. S. COAST GUARD

NATIONAL INSTITUTE OF HEALTH

FOGARTY INTERNATIONAL CENTER

NATIONAL SCIENCE FOUNDATION

NATIONAL ACADEMY OF SCIENCE

NATIONAL CREDIT UNION ADMINISTRATION

CENTRAL INTELLIGENCE AGENCY

EXPORT IMPORT BANK

AMERICAN REVOLUTION BICENTENNIAL COMMISSION

DEPARTMENT OF INTERIOR

DEPARTMENT OF AGRICULTURE

DEPARTMENT OF THE TREASURY

DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

GENERAL SERVICES ADMINISTRATION

GOVERNMENT PRINTING OFFICE

SMALL BUSINESS ADMINISTRATION

U. S. ATOMIC ENERGY COMMISSION

WHITE HOUSE

FEDERAL WOMAN'S AWARD

DEPARTMENT OF STATE "50TH ANNIVERSARY OF THE DIPLOMATIC COURIER SERVICE"

U. S. FRIGATE CONSTELLATION

# FUNDS DEPOSITED TO THE GENERAL FUND OF THE TREASURY FROM SALE OF NUMISMATIC ITEMS (In Thousands of Dollars)

Fiscal Year	Amount	
1960	762	
1961	1,325	
- 1962	1,733	
1963	1,856	
1964	1,025	
1965		
1966	4,679	
1967	9,207	
1968	5,998	
1969	11,940	
1970	7,409	
1971	6,274	
1972	39,889	
1973	23,830	

#### TOTAL COST OF REIMBURSABLE PROGRAM

Fiscal Year	Amount	_
1972 1973	\$22,250,000 \$29,588,000	

# FOREIGN COINAGE ACTIVITIES FISCAL YEAR 1973

#### COINAGE ACCOMPLISHED

HONDURAS 1972 DOMESTIC
LIBERIA 1972 DOMESTIC
LIBERIA 1972 PROOF SETS
PANAMA 1972 FAO 5 BALBOA
NEPAL 1972 PROOF SET
PANAMA 1972 PROOF SET
HAITI 1972 DOMESTIC
EL SALVADOR 1972 DOMESTIC
PHILIPPINES 1972 DOMESTIC

#### COINAGE IN PROGRESS

PANAMA 1973 DOMESTIC TIAWAN 1973 DOMESTIC LIBERIA 1973 PROOF SET

#### ORDERS PENDING

PANAMA 1973 PROOF SET ETHIOPIA 1973 DOMESTIC NEPAL 1973 PROOF SET HONDURAS 1973 DOMESTIC LIBERIA 1973 DOMESTIC For Previous Work Week

September 10, 1973

(Date)

				(	Date)					
PROGRAMS (Intitial order acceptance and cut-off dates)	% of Produc- tion & Ship- ping Cycle Lapsed	Cumulative No. of Orders	Cumulative No. of Sets or Medals	Average No. Sets or Medals Per Order	No. of Orders Shipped As of Previous Work Week	Cumulative No. Orders Shipped	% of Orders Filled	No. of Sets or Medals Shipped During Pre- vious Week	Cumulative No. Sets or Medals Shipped	% of Sets or Medals Shipped
List Medals (From first report of	Continuous	10,850	SM- 50,773 LG- 11,378	SM 4.679 LG- 1.049	182	9,401	86.7	SM 246 LG- 292	SM- 47,973 LG- 10,571	94.2
March 27, 1972)	Concentious		62,151	5,728				538	58,544	! .
1973 Proof Coin Sets Nov. 1, 1972 to Feb. 28, 1973	71.4	956,451	2,760,339	2.886	33,830	566,340	59.2	66,259	1,677,844	60.8
1973 Uncirculated Coin Sets Feb. 1, 1973-Apr.15,1973	82.9	657,400	1,767,691	2,689	26,091	563,610	85.7	73,741.	1,327,921	75.1
1973 Proof Eisenhower Dollar May 1, 1973-July 15,1973	, 64.1	412,048	980,039	2:378	34,823	248,448	60.3	109,501	523,734	53.4
Philatelic-Numismatic Commemorative (ARBC) July 4, 1973 - July 31, 73	56.7	261,184	468,069	1.792	. 0	0 —	0	0	0	0
1973 Penny Bags July 1973 - Way. 1413	. 54.5	14,427	184,090	12.760	0	0	0	0	0	0
1973 Uncirculated Eisenhower Dollar August 1, 1973 - OPEN	22.7	452,053	1,483,086	3. 280	0	0	0	0	0	0

List Medal Weekly Total - No. of Orders Received
1,073

No. of Medals Ordered SM- 1,509 LG- 720 2,229

Avg. No. of Medals Per Order

SM- 1.406 LG- 0.671

2.077

PREPARED BY THE PLANNING AND CONTROL BRANCH, SPECIAL COINAGE AND MEDALS DIVISION, WASHINGTON, D.C.

# LIMITED OFFICIAL USE

CODES: ACCEPT ORDERS PRODUCTION

PACKAGING ------PRODUCTION AND PACKAGING SHIPPING ......

SUGGESTED NUMISMATIC PROGRAMS 1973 & 1974

Ordering Sequence

1972

1973

1974

1975

Clean

Clean

Clean Clean

PROGRAMS Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June

ARBC Unique Package		(200,000 Silver Medals 94,000 orders) (400,000 Silver Medals 188,000 orders
Accept Orders Production &	BM/WCO	(200,000 Silver Medals 94,000 orders)  1/ + 2/ - (600,000 Bronze Medals 282,000 orders)  1/ + 2/ - (900,000 Bronze Medals 423,000 orders)  1/ 1/4 2/15  1/ 1/2/17 2/15  2/ 9/15 4/12  (400,000 Silver Medals 183,000 orders)  1/ + 2/ - (900,000 Bronze Medals 423,000 orders)  1/9/30 1/9/30 1/31 2/2/1 5/7
Packaging	Pa.Mint	<u>1</u> 11/12/12 2/15 1/9/30 1/31 2/15 2/17 2/15
Ship Orders	Pa.Mint	2/ 9/15
		<u>2</u> / 9/15
Proof Sets		2/ 12/1/ 4/12
Accept Orders	BM/WCO	
Production &	BM/WCU	_ · _ · _ (2,800,000 sets 969,000 orders) _ · _ (3,000,000 sets 1,038,000 orders)
Packaging	SFAO	2/21
Ship Orders	SFAO	2/21
Uncirculated Sets		
Accept Orders	BM/WCO	_ · _ · _ (1,700,000 sets 634,000 orders) (2,000,000 sets 746,000 orders)
Package &		
Insert	NYAO	2/26
Ship Orders	NYAO	2/26
		3/20
Proof Dollars		
Accept Orders	BM/WCO	(1,200,000 coins 531,000 orders) (1,500,000 coins 664,000 orders)
Production &		_ · _ (1,200,000 colls )31,000 colls (1,200,000 colls col,000 colls col,000 colls col,000 colls col,000 colls col,000 colls colls (1,200,000 colls col,000 colls col,000 colls col,000 colls colls col,000 colls coll coll
Packaging	SFAO	2/16
Ship Orders	SFAO	2/16
	02110	6/1511/8
ARBC (PNC)		
Accept Orders	BM/WCO	400 000 11 141 000 11 1
Production &	Dill WCO	(900,000 units 464,000 orders) (1,200,000 units 619,000 orders)
Packaging	Pa.Mint	
Ship Orders		5/149/2110/410/410/412/20
Ship Orders	Pa.Mint	9/15
Uncirculated Dollars		
	me trans	(a gas as
Accept Orders	BM/WCO	(2,500,000 coins 841,000 orders) (2,800,000 coins 841,000 orders)
Production	SFAO	3/1(2,500,000 coins 751,000 orders)  9/28  7/19/18  9/1712/28  7/19/13  10/1412/31
Packaging	NYAO	9/3=======12/14 8/5=======11/8
Shipping	NYAO	9/1712/28 10/1412/31
List Medals	***************************************	
Accept Orders	BM/WCO	
Production	Pa.Mint	1/2
Ship Orders	Pa.Mint	1/2
Penny Bags		
Accept Orders	BM/WCO	· (500,000 bags 40,000 orders)
Production	NYAO	8/1 8/31
Ship Orders	NYAO	9/1010/12
		77-20/12

America's First Medals

(Washington Before Boston & Maj. Gen. Gates, for Saratoga - Two Medals)

Accept Orders BM/WCO Production Pa. Mint Packaging Pa. Mint Ship Orders Pa. Mint

2/4-----7/25,000 Orders) 2/11=======7/27 2/18 ..... 7/31

 $\frac{1}{2}$ / Unique Silver  $\frac{1}{2}$ / Unique Bronze

Mrs. B. WAS ON When IKE & WAS CAUNCHED

Mrs. B. WAS ON When IKE & WAS CAUNCHED

BARBARA WARTORS HARRY LET HER

BET A WORD IN EDGEWISE:

PC W der - 927, Tin + Antimony + Copper

Did martha give gan e paper for me Covering Cortact regoliation vite/Southerner

#### Background

The Office of the Secretary in its internal management study recommended that the Mint and the Federal Reserve System develop a single mutually acceptable, coordinated system for determing short and long term coin demand.

Late in December 1971 the Director of the Mint suggested that the Federal Reserve Board assume the responsibility for estimating short and long term coin needs. After the Board accepted that responsibility we experienced the usual problems that follow such changes. Naturally strong doubts developed about the Federal Reserve providing realistic estimates, and their estimates have been off many times. However, they have made much progress toward the development of a meaningful coin forcasting program.

Through close cooperation from the Office of Production and my staff, the Board and the Mint is developing a smoothe and efficient functioning system. By fiscal 1973 we had reduced our error factor to less 2 percent on a total basis. Since that time the Board staff has developed a model for estimating the demand for cents with reasonable accuracy. It may be possible to use this model in estimating all denominations.

Many additional factors are now being considered both by the banks and the Board in making their estimated coin requirements. For example, the Board is requesting input from local users of coin rather than depend entirely upon the larger members banks for data. A closer more refined analysis of data is being made by the Board and the Mint.

Coin Forecasting, Production, and Distribution

The primary responsibility of the Mint is to strike sufficient coins to meet the needs of the nation's commerce.

It performs this function by planning production and shipping schedules on the basis of coin requirement estimates provided by the Federal Reserve Board's Division of Bank Operations.

The primary objective of the Federal Reserve Liaison Division is to evaluate and coordinate these estimates with the Mint's Assistant Director for Production. Another objective is to coordinate coin shipping schedules to maintain sufficient coin inventories at each Federal Reserve Bank and Branch to fill commercial bank requests.

We meet these objectives by tabulating, summarizing, and analyzing coin activity statistics reported by the Mint and Federal Reserve Banks. These data are then used to develop statistical trends to appraise bank estimates and to schedule production and shipments.

Coin reports prior to 1967 were tabulated manually. As coin demand increased, some degree of automation was necessary to process statistical data to effectively service expanding bank needs. Accordingly, since 1967, EAM equipment has been utilized to process some of these requirements. The continuing surge and wide fluctuation in coin demand requires increased levels of inventories. The Feds, however, have not expanded their storage facilities to keep pace with growing demand. Thus, an accurate and timely reporting system is needed to

maintain inventories at each Fed within limited parameters.

This information must be processed efficiently so that Management can effectively coordinate production and shipping schedules with bank needs.

Mint's efforts are continually directed towards refining techniques to minimize variances between actual and estimated coin demand. Our objectives are to improve operations by: (1) reducing overuns which result in costly storage expenses,

(2) avoiding shortages which disrupt programmed production and shipping schedules and thoroughly disorganize functions for banks and commerce, (3) providing the Production with timely requirement reports for production planning.

Mint's current requirements are outlined below:

- I. FRBanks wire the Mint weekly coin reports of inventories and receipts.
  - A. The Mint's EAM Division lists data and calculates weekly and four week average net outflow.
    - Reserve Board and the Mint's Liaison and Production Divisions to schedule and adjust monthly shipping programs.
- II. FRBanks report monthly coin activity summary which shows:
  - (1) Inventories
  - (2) Receipts from the Mint
  - (3) Receipts from commercial banks
  - (4) Payouts to commercial banks

- (5) Net outflow (demand)
- A. The Mint's EAM Division lists data and summarizes it monthly, quarterly, semi-annually, and annually.

  Data is stored to project coin demand to evaluate:
  - (1) Projected requirements on a monthly, quarterly, and annual basis
  - (2) Bank requirements and schedule production programs for the quarter

A system should process requirements previously outlined so that Management may allocate more time to evaluation rather than calculation, and have the capability and flexibility to perform the following functions:

- A. Coin forecasting
  - 1. Project bank demand by years
  - 2. Project bank requirements by years
  - 3. Revise projected requirements for each year
  - 4. Revise requirements each quarter 2 1/2 months prior to the beginning of each quarter for production planning and ordering raw materials
  - 5. Schedule monthly shipments
- B. Tabulate coin activity on a monthly, quarterly, and annual basis
  - 1. Develop data bank to:
    - a. Calculate estimated demand
    - b. Measure validity of bank requirements
    - c. Evaluate and project inventory positions

- d. Schedule coin shipments to maintain inventories at each Federal Reserve Bank within the parameters of maximum and minimum levels to meet fluctations in demand.
- e. Measure impact of any budget reductions

MAY 1977 EDITION UNITED STATES GOVERNMENT

## *Iemorandum*

: All employees attending Director of the Mint's TO

DATE: May 15, 1973

Conference in Philadelphia, April 30, 1973

FROM

: Mary Brooks

Director of the Mint M R

SUBJECT: Minutes of Director of the Mint's Conference, Philadelphia, April 30, 1973

Attached for your information is a copy of the minutes taken at the recent Director of the Mint's Conference in Philadelphia on April 30, 1973.

Included, as an attachment, is a list of unresolved items requiring action.

Attachment

#### RECEIVED

MAY 29 1973

OFFICE OF SUPERINTENDENT U. S. MINT AT DENVER

- Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

### RECEIVED

MAY 29 1973

OFFICE OF SUPERINTENDENT U. S. MINT AT DENVER

Director of the Mint's Conference

Philadelphia, Pennsylvania

April 30, 1973

#### Director of the Mint's Conference Philadelphia, Pennsylvania April 30, 1973

Mrs. Brooks opened the meeting by welcoming all those in attendance. A few items of business discussed on Sunday, April 29, the first day of the conference, were settled and it was noted that the Secret Service survey recommendations on security were handed to field supervisors at today's session. Mrs. Brooks turned the meeting over to Mr. MacDonald, who briefly discussed the day's topics. The first topic discussed was quality control of coins in the Mint.

Dr. Goldman stated that we now have quality-control groups in each coin producing field office. These groups are essentially roving-inspection teams that inspect newly minted coins. The statistical sampling techniques now in use are considered to select a more representative sample of the coins that we are producing. With the addition of quality control personnel at all coining offices and the quality control report that is prepared monthly, production personnel are becoming more quality conscious. When the Bureau laboratory in Main Treasury building moves to the Warner Building, and wet assaying is no longer performed in Washington, more burden will be placed on the field offices for quality control.

Dr. Goldman went on to say that there are two dangers in producing a poor quality coin. The first and most important danger is that of counterfeiting. The poorer the quality the more easily it is to counterfeit. The second danger of poor coin quality is that the Numismatists are looking much closer at our coins and those with errors are generating more publicity today than previously. This results in bad publicity for the Mint.

He proceeded to introduce Mr. Johnson, Chief of the Assay Division, who narrated slides on defective coins recently collected in samples from field offices. The first slide presented was what Mr. Johnson called a stone die error. This was evidenced by the "L" from Liberty missing on the obverse of the 1¢ coin. The cause of this type of error is that too much polishing was done on the dies. Other common coin errors were the chip out, wedge-shaped, die crack, die clash, fins, off-centered, and double-obverse die.

Mr. Johnson mentioned that the wedgenshaped error, which is a thinning on one side and a thickening on the other side of the coin, can cause problems in vending machines. He stated that the dime is the most critical of all coins because of its small size and, if we do not stay within the tolerance established the coin will hang up in the coin slot of pay telephones. He also stated that when the coins are received in Washington as part of the quality-assurance

program that it is too late to do anything on most of the causes of poor quality. Errors discovered while taking a sample require prompt action to eliminate the cause. The importance of having good strip was mentioned as a first step toward improved quality.

Dr. Goldman mentioned that one problem in controlling quality is that feeder mechanisms are not adequately maintained. New and improved feeders are now on order for Denver and expected delivery is approximately six months. Philadelphia has a much higher proportion of these new and improved feeders. Another slide shown by Mr. Johnson depicted the coin error prices that Numismatists are willing to pay for Mint coin errors. The prices ranged from 5¢ to \$35, depending upon the type of error and the denomination. Mr. Johnson handed the meeting over to Dr. George Hunter, Quality Control Manager, who discussed what we can do to improve quality control.

Dr. Hunter mentioned that the objective of quality control is to get a representative sample of the coins being minted and, these coins should be taken at the presses, not from the tanks. This prompted a discussion on the sampling technique applied at Denver with Mr. Lawrence, Mrs. Higby, Dr. Goldman and Mr. Ambrose participating. It was decided that a separate meeting would be held on May 1, in order to iron out the difficulties with the selection of coin samples.

On introducing the next speaker, Mr. Ambrose, Assistant Director for Production, Mr. MacDonald posed the question: Will we be able to meet demand in the future? Mr. Ambrose started his discussion on "Domestic Coin Production Outlook" by informing the group that the daily production rate of all Mints is between 40 and 45 million pieces per day. Of this quantity, 3 million pieces are being made for sets in San Francisco with the remainder being produced in Philadelphia and Denver. It is projected that San Francisco will produce 350 million 1¢ pieces in calendar 1973. It was mentioned that we may not produce any \$1 pieces for the remainder of the calendar year due to the fact that expected demand is now equal to what is in the Mint's vaults. In projecting coinage demand in fiscal years 1974 through 1980 the lc piece will be the dominant coin produced at each of the Mints. A slide was shown that portrayed the expected coin-denomination mix through fiscal year 1980. It showed the 1¢ coin as 75% of production, 5¢ coin as 6.5%, 10¢ coin as 9.8%, 25¢ coin as 5.6%, 50¢ coin as 2.3%, and the \$1 coin as .8% of the total produced. These figures excluded any increase in demand for the production of the bicentennial year coins, the 50¢ and \$1 pieces.

Mr. Ambrose continued by showing a slide of the projected coinage demand through fiscal year 1980. This slide depicted two forecasts, one being the Federal Reserves projection and the other being what was called the "Hunter curve". The Federal Reserve's expected coinage demand was 15.4 billion coins by 1980, whereas the "Hunter curve" projected 17.8 billion coins by 1980. Mr. Ambrose stated that the Mint "was gearing up for the worst" or 17.8 billion

coins. At this point, Mr. MacDonald pointed out the many problems in fore-casting coinage demand. Two years ago the Federal Reserve projected a coinage demand of 12.3 billion coins by 1980. This is in sharp contrast to the 15.4 billion which they are now projecting. Also, Mrs. Brooks mentioned that the passage of a new coinage bill, which would allow for design changes on the reverses of the Eisenhower dollar and the Kennedy half dollar in honor of the nation's 200th anniversary, may cause a large increase in the demand for the 50¢ and \$1 piece coins.

With the addition of new presses in Denver and Philadelphia, and the replacement of dual with quad striking presses, Mr. Ambrose believed that we could increase our capacity significantly. Once these changes are effected and the Mints and Assay Office are operating on a three shift basis, the productive capacity for Philadelphia is expected to be 9.9 billion coins, 6.6 billion in Denver, and 2.3 billion in San Francisco, the latter consisting of 1¢ and possibly 10¢ denominations.

Brief mention was made of using the West Point facility for the production of foreign coins. Mr. Ambrose mentioned that we still need Treasury and Congressional approval before this could take place. Mrs. Brooks stated that the Mint's statutes have not been extensively modified since 1883, and she is optimistic that changes can be made allowing for the production of foreign coins at our West Point facility. Plans for West Point call for the production of 200 million foreign coins per year. Blanks would be manufactured at the other Mints or purchased and shipped to West Point for stamping and shipping.

In a discussion on storage and shipment of coins, Mr. Ambrose mentioned that the Federal Reserve Banks haven't the storage capacity for the large amount of coins that the Mints are producing. The Philadelphia and Denver Mints also have large amounts of coins in their inventories. However, the months of June, July and August have historically shown large increases in coinage demand. The large inventories of 50¢ and \$1 pieces may be shipped to West Point for storage.

Mr. Frank Rhea, Project Manager, was next introduced to report on the progress of the new Denver Mint. Mr. Rhea welcomed ideas from all sources and stressed the need for group participation in all phases of the project. It is anticipated that the new Mint will produce approximately 7.7 billion domestic coins per year. All functions for the 1¢ and 5¢ coins will be performed from the receipt of the virgin metal to the completion of coinage. No foreign coinage capacity has been identified at this time. The new Mint will be limited to the manufacture of strip for 1¢ and 5¢ coins. Space will be provided for 50% expansion. No provision has been made for clad-strip production. Additional expansion space will be provided which will increase the total production capacity to 10.94 billion coins.

These capacities are predicated on a two shift per day, five days per week, 240 days a year basis. The Melting and Casting Section are predicated on a three shift basis. Separate buildings or areas will be provided for: 1.) melting, casting, hot rolling, and surface milling; 2.) strip finish, blanking, coining, storage and shipment; 3.) proof coins; and 4.) administrative and support functions.

The production concept is based on a single story sequencial flow with a minimum of vertical movement of production material. It is expected that the total square footage will be approximately 620,000 square feet. The Philadelphia Mint is 475,000 square feet. It is anticipated that by August 1, 1974, the site will be turned over to the Mint.

A timetable was presented that scheduled some future actions:

June 1, 1973 - start design;
October, 1974 - procurement contracts for processing equipment;
January, 1975 - start site building construction;
January, 1977 - start equipment installations;
1978 - complete building/equipment installation;
1979 - relocate equipment
January 1, 1980 - startup/fully operational.

The plan for the site area was shown by a chart which depicted the buildings being adjacent to the Platte River with a shape resembling a boomerang. Mr. McGee suggested that security be consulted at each step of construction phase in order to facilitate the safeguarding of the buildings and coins. Mr. Rhea indicated that the separation of buildings should improve security in that the use of color-coded badges would indicate the working area of employees.

Mention was also made of the possibility of the Platte River overflowing. Mr. Rhea stated that he didn't feel that this would be a problem and that this happened only rarely. In any event, the coining area and the administrative building will be placed on higher ground than the melting and casting area and, all buildings will be thoroughly waterproofed.

The meeting then recessed for lunch and upon returning, Mrs. Brooks discussed the "Status and Plans for the Old San Francisco Mint". She stated that the Old Mint is the first public building to conform with Public Law 92-362 of August 4, 1972, for the adaptive use of surplus historic structures. The restoration of the building is still in progress and will take another year or two before the exterior is restored to its original appearance. It is anticipated that the museum portion will open on approximately the first week of June. This section will contain many original pictures and furniture items that have been around since the Mint opened

in 1874. An old press from the San Francisco Assay Office will be installed and children will be able to buy blanks and have medals struck by the old press. The medals will be placed in a bag made of polyethylene. Exhibits of the Old West will also be installed. The Mint is also negotiating for the making of a film entitled "The Granite Lady" which is an appropriate title for the Old Mint and the material of which it is constructed. Mrs. Brooks also mentioned that the Old Mint is of the Greek revival architecture.

At this point, Mr. MacDonald said that much assistance has been received from the Office of the Secretary and other Treasury agencies. He gave the example of the clad-strip study which is being conducted by a joint committee of the Office of the Secretary and Mint personnel. The Secret Service survey is a good example of other Treasury agencies helping the Mint to improve its functions. Mention was also made that the Warner Building is now under lease by the General Services Administration for Treasury use. The type of security problems that we have experienced at 1331 G Street are not anticipated when we relocate to the Warner building. Mr. MacDonald then requested the field personnel to introduce topics of their choice.

Mr. Bland Brockenborough, Officer in Charge of the San Francisco Assay Office, started the field office discussions by stating that there has been many changes in the past year at the Assay Office. A specific example was the inclusion of the proof dollar in the Mint sets. They have received 2.78 million orders for this set. Mr. Cahoon mentioned that the response from the public for the 1973 proof sets has been very good. There has been but one complaint with none on the non-receipt of their sets.

In regards to the disorder or people problems that San Francisco had experienced in the prior year, Mr. Brockenborough believed that they no longer have this problem. He cited that their improvement in labor-management relations should minimize any problems in the future. Mr. MacDonald praised the work of Miss Eileen Lusby, and Messrs. Pete Brawner, Jim McGee and Brockenborough for handling the affair with "cool heads" and, he stated that the problems are gone and no reoccurance is expected.

Mrs. Betty Higby, Superintendent of the Denver Mint, was introduced. She stated that most of the problems of Denver have already been discussed or will be discussed at a later time. Mr. Hildreth Frost, Chief Assayer of the Denver Mint, submitted a plea for the standardization of equipment between the Denver and Philadelphia Mints. He stated that they both have similar problems that need to be brought up-to-date. In particular, he mentioned the quality control problem and the question of feeders on the coining presses. This, he said, is a complex problem that they are working on in order to improve the quality of coins. Denver has ordered twelve (12) feed-o-matic feeders which will improve this situation. The mechanical sections of both Denver and Philadelphia have developed a better feeder system that should improve the quality of our coins. Mr. Frost, continuing,

stated that Denver had many old presses and that the Building and Maintenance Department had established a definite system of preventive maintenance on all presses.

He reiterated the need for equipment standardization. It was noted that some further engineering was required and support from top management would make improvement a reality. This he stated, would be a step toward greater quality control and also an improvement in cost. Mrs. Brooks inquired as to why a study made in 1967 on standardization of coining methods had not been implemented.

Dr. Goldman stated that the problems were the same throughout the Mints and much had been done in the past year to improve the relationships between the field institutions. He further stated that they expect to reach an agreement in the May 1 meeting on the standardization of the equipment.

At this point, Mr. MacDonald stated that there have been many disagreements in the past as to coin making. He cited a recent trip by Mr. Frost to Philadelphia that resolved many differences. He emphasized that their was a need to have an open mind in all functional areas in order to solve problems that come up.

Mr. Victor Harkin, Officer in Charge of Fort Knox, discussed briefly the visit by Mrs. Brooks to his facility and the removal of certain pieces of furniture for use in the Old Mint. He also mentioned that Fort Knox was a storage facility for many other types of material for other Government agencies.

Mr. Theodore, Superintendent of the Philadelphia Mint, spoke next and stated that many production problems are the same at all locations. He emphasized that each Mint could gain valuable knowledge from the other and, suggested that we have more conferences especially at the operating level. He praised Mr. Rosenbaum and Mr. Breen for their contributions in the production program.

Mrs. Brooks stated that the idea of having additional conferences would be beneficial to all. Mr. MacDonald mentioned to Mr. Ambrose that production could now hold a Mint-wide production meeting because of the addition of new people in that department.

Mr. Costanzo, Superintendent of the New York Assay Office, discussed briefly the accomplishments of his office in the past year, including refinery outputs, the packaging and shipment of uncirculated coins and penny bags.

As for the Carson City Dollar Program, he stated that the General Services Administration spent 1/2 million dollars to improve the working area at our West Point facility. This included a new lighting system and air conditioning.

This program is progressing very well and 20,000 Carson City Dollars are currently being mailed each working day. Half of the employees hired to package and mail the dollars are to be laid off in June, and the remaining employees are to finish the program by September. He praised Mr. Harry Edwards for his work and accountability of the Carson City Dollars. Not one coin was missed.

With the decline of this program plenty of storage space will be available, of which a portion will be used for storing some old stamping presses.

Additional programs were welcomed by Mr. Costanzo for making use of this space and also his employees.

Mrs. Brooks stated that if the coinage bill passes for design changes, the National Sculpture Society would run competition for designs on each of the two coins. They may get 1/2 million pieces of mail in art work and, West Point would be an ideal location for the receipt of this mail.

Mrs. Higby of the Denver Mint inquired about a bill that was introduced on April 3, calling for the Denver Mint to strike medals marking Colorado's Centennial. This bill seeks a maximum of 250,000 medals for the August 1, 1976, observance. Mrs. Brooks stated that she was optimistic on the passage of this bill.

Mr. McCoy, Chief of Data Services in the Washington office, spoke next of the Bureau's proposed ADP System. He spoke of a data network which would link the West Coast Operations with other field locations and the Washington office. The ADP System that he was proposing could have wide applications throughout the Mint. The time frame for the proposed plan was approximately 4 to 5 years from today. However, the meeting of this time frame depends upon the amount of money budgeted for this purpose.

Mr. Elmer Hinson, the EEO Officer, spoke briefly on the Upward Mobility Program and other equal employment opportunities within the Mint. The Upward Mobility Program, he stated, is designated to benefit those at GS-7 level and below. It is designed to help them qualify for better jobs. He requested that he be informed about the programs now conducted and to be conducted at each of the Mint Offices. He felt that more work was needed in the program. He added that by more he means to progress enough to identify, by sex and race, the accomplishments of the Upward Mobility Program. He stated that they now have nine programs in process at Philadelphia that were not previously identified as Upward Mobility Programs.

Mrs. Margaret L. Walker, the Federal Womens' Program Coordinator, spoke briefly on her program. She stated that the program was mainly to advance women by giving them opportunities through training and experience. Mrs. Higby mentioned that they now have a woman working as an upsetting machine operator in Denver. She further stated that they have offered women opportunities

in other areas but, they have not been too interested because of the heavy physical work involved. Mrs. Walker, continuing, said that she expects to make further strides in the advancement of the womens' program. Also mentioned was the wealth of information contained in the Director's Annual Report that she is responsible for preparing each year. She also requested that field offices having information for possible inclusion in the Annual Report to forward this information to the Director's Office.

It was announced by Mr. MacDonald that on Tuesday morning there would be a work-shop conducted by Mr. Gus Ferguson, Chief of the Internal Audit Staff, to familiarize the chairmen of the settlement committees with the recent revisions to the "Annual Settlement General Instructions".

On this final note, Mrs. Brooks adjourned the conference by reiterating the importance and benefits to be obtained from these conferences.

Attachment A: List of employees attending Director of the Mint's Conference

Attachment B: List of unresolved items requiring action.

#### MINT CONFERENCE - PHILADELPHIA

#### Washington

Mary Brooks Frank MacDonald Roy Cahoon X Sidney Carwile \* Alan Goldman George Ambrose Howard Johnson George Hunter Frederick Tingley Sherman Brawner X 250400 Charles Fincher > ..... J. E. Sparks Francis Frere Julius Justice Harold McCoy Eugene Miller James McGee Gus Ferguson William Humbert Margaret Walker Glen Williamson James Clawson - O/Sec. (Sunday only)

#### New York

Nicholas Costanzo

Harry Edwards

Joseph McMahon (Sunday only)

Joseph Nugent

John Wright (Sunday only)

Marie Control of the Marie Control of the Control o

#### Denver

Betty Higby Harry Lawrence Hildreth Frost Frank Rhea Dean Permenter (Sunday only)

#### Fort Knox

Victor Harkin Roy Geho (Sunday only)

#### San Francisco

Bland Brockenborough Richard Voss Thomas Ng Bill Patrick Ken Conner

#### Philadelphia

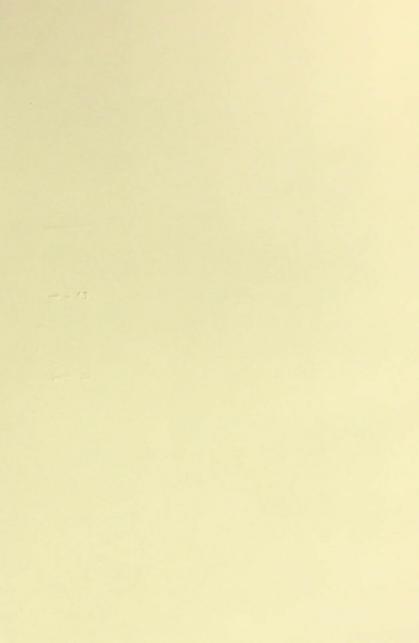
Nicholas Theodore
Danny Costanzo
Seymour Rosenbaum
Frank Breen
Elmer Hinson
Louis Frederico (Sunday only)
Jack Carroll

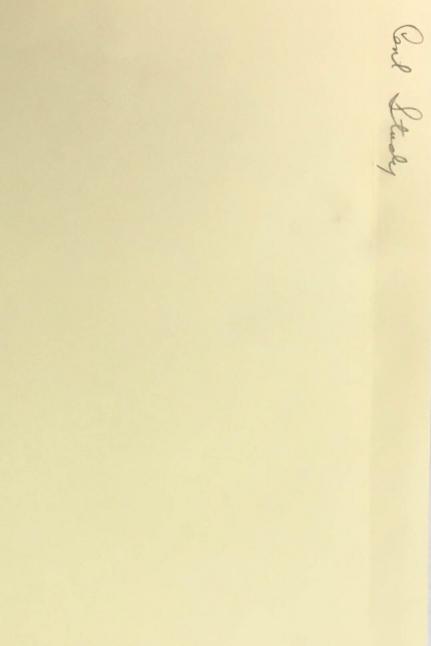
#### Director of the Mint's Conference Philadelphia, Pennsylvania April 30, 1973

#### Unresolved Items Requiring Action

# Items: 1.) Standardization of equipment among field offices 2.) Elimination of coin feeder mechanism problem. Goldman 3.) Clearly defined procedures for coin sampling. Goldman 4.) Need for improved coin projections. Cahoon 5.) Mint-wide production meeting. Ambrose

Queen of Ment Meetings





# Paper Penny Scrip May Ease Shortage

soon will receive official Treas-might object to scrip in prinury Department permission to hand out paper scrip instead of pennies as change because of the shortage of the copper coins, department sources say.

Some retail businesses already have begun issuing scrip for lack of pennies, while others have held off to await a Treasury ruling on the practice.

Sources said Friday that Treasury attorneys have concluded that use of the paper pennies within one store would be legal but are still trying to determine what defines a store.

The problem is whether the scrip should be honored only in the store where it was issued or in any store of a particular chain.

Mint Director Mary Brooks said in an interview that the paper scrip probably wouldn't ped because of the falling price be popular with consumers be- of copper and the vending macause they couldn't spend it as chine industry's opposition.

WASHINGTON-(AP)-Stores regular currency and some

Mrs. Brooks said she was hopeful that the need for scrip would be over by the end of the summer, as more persons return their copper pennies to circulation.

The Treasury has designated June as get-out-the-penny month and will issue special certificates to persons turning in \$25 or more in pennies to banks or other commercial outlets.

Mrs. Brooks conceded that the mint may have been partially to blame for the penny shortage because its proposal earlier this year to stamp one-cent pieces from aluminum caused many people to begin hoarding the copper coins in hopes they would increase in value.

The proposal has been drop-

## ACTUAL AND PROJECTED COIN DEMAND FISCAL YEARS 1961-1980 (Millions of Coins)

FISCAL YEAR	CENTS Pieces %		NICKELS Pieces %		DIMES Pieces %		QUARTERS Pieces %		HALVES Pieces %		DOLLARS Pieces %		TOTAL DEMAND
1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971	2251 2600 2566 2884 2927 3388 3339 4037 5285 5243 5309 5604 6370	84.6 82.3 77.6 72.3 64.7 61.4 68.3 58.3 57.0 72.0 74.3 74.6 75.1	25 37 42 66 123 303 253 475 601 552 488 452 568	0.9 1.2 1.3 1.7 2.7 5.5 5.2 6.9 6.5 7.6 6.8 6.0 6.7	263 424 456 697 994 948 551 1601 2051 904 745 641 757	9.9 13.4 13.8 17.5 22.0 17.2 11.3 23.1 22.1 12.4 10.4 8.5 8.9 8.9	98 45 180 188 285 685 597 508 1226 500 460 310 513 540	3.7 1.4 5.4 4.7 6.3 12.4 12.2 7.3 13.2 6.9 6.4 4.1 6.0 5.9	25 53 63 152 196 191 148 305 107 82 148 350 211 170	0.9 1.7 1.9 3.8 4.3 3.5 3.0 4.4 1.2 1.1 2.1 4.7 2.5 1.9	     154 70 75	     2.1 0.8 0.8	2662 3159 3307 3987 4525 5515 4888 6926 9270 7281 7150 7511 8489 9145
1974 1975 1976 1977 1978 1979	6950 7582 8271 9024 9845 10740 11717	76.0 76.0 76.0 76.0 76.0 76.0 76.0	595 648 707 772 842 918 1002	6.5 6.5 6.5 6.5 6.5 6.5	815 888 969 1059 1153 1259 13721	8.9 8.9 8.9 8.9 8.9	588 642 700 764 833 910	5.9 5.9 5.9 5.9 5.9 5.9	190 207 226 246 269 293	1.9 1.9 1.9 1.9 1.9	80 87 95 104 113 123	0.8 0.8 0.8 0.8 0.8	9976 10,883 11,874 12,954 14,132 15,417

OFFICE OF PUBLIC SERVICES BUREAU OF THE MINT April 26, 1973

## The Department of the TREASURY

NEWS

BUREAU OF THE MINT WASH., D.C. 20220 - W04-5011



RECEIVED

THE HONORABLE MARY T. BROOKS

DIRECTOR OF THE BUREAU OF THE MINT

BEFORE THE SUBCOMMITTEE ON CONSUMER AFFAIRS

OF THE HOUSE BANKING AND CURRENCY COMMITTEE. S. MINT AT DENVER

MARCH 27, 1974, at 10:00 a.m.

Madame Chairman, I welcome the opportunity to appear before your Subcommittee in support of H.R. 11841, a bill which would grant the Secretary of the Treasury stand-by authority to adopt a new alloy for the penny. In substance, the bill would authorize the Secretary to alter the alloy for the penny when he determines that the current composition is no longer practicable.

We have no intention of changing the present copper cent in this calendar year. We have enough copper from the GSA stockpile to see us through the year of 1974. I would like, if it is at all practical, to make no change in the present bronze cent or lower the copper content. With the ending of the oil embargo by the Arabian countries, we have hopes that the price fluctuations in world commodities may be moderated. There are already signs that business is returning to a somewhat more normal state, and some commodities are already coming down. However, in the face of these statements let me review for you the reasons for our urgent request for this bill, H.R. 11841.

The activities of the metal market since the summer of 1973 have

surpassed the expectations of even the more imaginative speculators. In this market we have seen the price of copper spiral from an early summer low of 50 cents a pound into the \$1.28 range of this past week. The arithmetic associated with our penny business is quite simple. The value of the metal in the coin plus the cost of labor required for manufacturing should remain below one cent. At a metal cost of slightly less than \$1.20 a pound for copper, we reach the point where it costs us more than a penny to make one. Treasury is in no way objecting to the possibility of continued one cent production at a lower profit than we have realized in past years. The real problem we are faced with is that at some point in this continually rising market, the value of just the copper in a penny will exceed one cent.

The rapid increase in the copper market has given rise to considerable speculation, and since the beginning of the year, vast quantities of pennies have been pulled from circulation. We are currently experiencing outflows in excess of 200 per cent of those experienced at the same time last year. We must assume that this is in anticipation of the market reaching over \$1.50 a pound. At that price, the value of the copper in the penny exceeds one cent.

We have been and are continuing to be confronted with requests by the Federal Reserve to ship more pennies than our current production configuration permits us to manufacture. The Federal Reserve is responsible for making an equitable and impartial distribution of available supplies of coin. They, too, are faced with increased pressure for deliveries of inordinate proportions. The time for action has come

much sooner than we had ever anticipated.

We did become quite uneasy in October and November of this last year as we began recognizing strong market indicators of imminent price leaps. With great foreboding, I instructed my staff to more speedily conclude the initial phases of a study that we undertook in July which dealt in part with a suitable replacement for the metallic alloy of this one cent piece.

Our specifications for a replacement alloy were directed to our primary mission — that is, to produce adequate coinage to insure smooth continuation of the Nation's commerce; to maintain the confidence of the public in our monetary system; to produce the least negative impact upon public and private interests; and to be in sufficient quantities that product prices would not be predicated upon the availability of any denomination.

We have seen in our travels to investigate the coinage of other nations that in some very unhappy situations where coin is not in adequate supply, "change" is made in the form of low cost goods such as candy and gum, or by rounding to the next highest denomination. Our specifications dictated that any replacement for our current-95 per cent copper, 5 per cent zinc penny be of an alloy that could be processed at a similar speed and an equal quality through our existing facilities.

As metal passes through the processes in preparation for coining, it is cast into ingots, rolled into thin strip, stamped into blanks, softened slowly in annealing furnaces, and finally impressed with the unique design of the coin. To dramatically perturb any of these processes

by the introduction of an incompatible alloy results in the slowdown of the final output. If those annealing furnaces in which we soften the coin prior to stamping must be reduced to half their current speed, it leaves us with only the alternative of producing half the product. If the selected alloy when prepared for coining is of a hardness greatly in excess of our current bronze material, we will experience excessive die wearing and cracking. If these coining dies deteriorate, they must be replaced, and again production suffers and costs skyrocket.

The new coin must have public acceptance and also reflect every possible property necessary to satisfy those industries which have been developed around the current product. These of all other factors I recognized to be the most sensitive and to hold the greatest potential for opposition. We consulted with people from both the public and private sectors in evaluating our capability to produce this greatly demanded denomination. After extensive deliberation, we determined that there would be no change in the dimensions or the motif of the one cent piece. This left color and weight as the two alterations that the public might eventually be asked to accept.

We investigated methods to produce a coin which would in appearance and weight differ only slightly, if at all, from the current one cent piece. Perplexing problems developed in every effort to do so. We have established in our Mint facility in Philadelphia, Pennsylvania, a research and development laboratory complete with coining press; there, through the weeks and weekends, my staff, with invited representatives of interested organizations, tested and analyzed the coin produced from the

various alloys with which we experimented.

We invited the Federal Reserve to solicit the opinion of the many banks of this country to our anticipated alloy change. They enthusiastically accepted penny blanks of selected alloys and ran them through their various mechanical handling devices. They reported no significant problems.

The vending machine industry met with my staff and me here in Washington to enable us to give full consideration to their needs. They reviewed our testing procedures and offered suggestions that gave us new insights into problems they anticipate.

We have openly conducted conferences with the various news media to insure that the majority of the public is fully aware of the conditions by which a change in the one cent alloy has been dictated.

From an historical point of view, I regret being the Director of the Mint who, for the Administration, is testifying on behalf of a change in this coin that has been in existence in our country's commerce for almost two centuries. I am, however, sensitive to any hardship or expense this may force upon individuals or industries of our country. It is inherently the responsibility of Government to encourage business growth, not to be a detriment to it. That is why I have so energetically solicited the participation and thoughts of all responsible parties who might have an interest in our proposed legislation.

I have proposed an in-depth study on future coin denominations and alloys. This will be conducted hand-in-hand with public and private interests affected. I would like to advise this Subcommittee that we have even received a magnanimous offer from one industrial source to

enter into this project on a cost sharing basis.

I hope we have left no stone unturned. Energy consumption and the effects of a new penny alloy upon the environment have been considered in our reviews. Indications that the energy crisis is waning come from the announcement of the lifting of the Mideast oil embargo. We may optimistically look to a greater stability in the price trends for commodities as we anticpate benefits from newly opened and restored energy sources.

It must be clearly emphasized that this proposed legislation is discretionary. We have no intention of asking the Secretary for any change in the metal content of the penny during this calendar year or at any time until we are left without another course. We produce in excess of 30 million pennies during each of our operating days. This supply is adequate for commercial demands. The balance of supply and demand can be ruined, however, by the selfish actions of a few unscrupulous speculators who place the possibility of unrealistic profits ahead of the national interest.

The hoarding of pennies and their ultimate melting for sale for copper value can and will be made a criminal offense when the Secretary of the Treasury determines that such a measure is needed to stop any disruption to our economy.

A change in alloy will be to one which we have assured ourselves is most in keeping with our previously stated missions in the economy of this country. The exhaustive testing that we have performed to date is well documented in report form and has been supplied to all who have asked for it. I would like, at this point, to submit for the record

our report, entitled "Alternative Materials for One Cent Coinage", dated December 1973, with an accompanying letter providing results performed subsequent to preparation of the basic report. As you will see from our report, our current conclusions lean toward an aluminum alloy.

The economics of this Nation and technical findings will provide the guidance that the Secretary will require in making his final determination in this matter.

This, Madame Chairman, concludes my statement, and I will be glad to answer any questions you may have.

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# Copper penny may be on way out

WASHINGTON (UPI) — The copper penny soon may be going the way of the nickle beer.

The problem is that it now

costs more than a penny to

make a penny.

The House Consumer Affairs subcommittee heard testimony Wednesday on legislation to change the composition of the penny from 95 per cent copper and 5 per cent zinc to a 96 per cent aluminum alloy and 4 per cent various other metals

The legislation was urgently requested was urgently rerequested by the U.S. Mint when copper prices began rising sharply last year. Copper futures now are selling for \$1.40 a pound, and it is not economically feasible to continue making copper pennies.

The problem is further complicated by "hoarders" and speculators buying up pennies on the assumption it soon will pay to melt them down and sell the copper.

Mary T. Brooks, director of the mint, told the subcommittee the mint had enough copper stockpiled to make pennies the rest of this year. But after that, she said, if the price of copper holds or rises "the value of just the copper in a penny will exceed one cent."

Mrs. Brooks recommended the mint be given standby authority to change to the aluminum alloy or, barring that, to make it a 70 per cent copper-39 per cent zinc composition.

Most of the opposition came from vending machine operators who testified the aluminum coin could jam their machines

"It's entirely a matter of weight and the underweight aluminum coin would jam the machines," said Richard Schreiber, president of the National Automatic Merchandising Association.

He said tests showed the aluminum penny would not work from about 5 to 10 per cent of the time, depending on the machine and how the coins are inserted.

Figuring only a 1 per cent failure rate, Schreiber said there would be more than 840,000 frustrated purchases a day in the United States and each service call on a jammed vending machine would cost \$15.

"I should not be at all surprised if many of the consumers retaliated forcefully against the machines," he said. "And I'm certain that some would also blame their government for making coins that incapacitate some 4 million yending machines."

"Inflation is bad enough already," Schreiber said. "This country doesn't need a penny that will blow away in the wind like streakers on a college campus."

Spokesmen for the Federal Reserve Bank testified that there already is a "run" on pennies and said they have asked their individual banks to "discreetly screen" all bulk penny orders.

Rep. Stewart B. McKinney, R-Conn., suggested the onecent piece may be obsolete and said, "Why don't-we just start making two-cent pieces and solve all the problems?"



## DEPARTMENT OF THE TREASURY WASHINGTON, D.C. 20220

MAR 2 6 1974

Dear Madame Chairman:

Although the attached report on alternative penny materials has previously been made available to you and members of your Subcommittee, I thought you might find it useful to have a synopsis of the salient points of the report, including additional information which we have recently gathered, for the hearing you have scheduled on H.R. 11841 for March 27.

Our request for this legislation is necessitated by the continuing rapid increase in the price of copper on the world market and the resulting heavy outflow of pennies from the commercial banks. The abnormal heavy demand for pennies, which can only be explained by speculative hoarding of pennies for their metal content, is seriously taxing our production capacity. Under these circumstances, we would be remiss in our mission of assuring an ample and uninterrupted supply of coins for our Nation if we failed to take the necessary steps to halt the disappearance of pennies from circulation. The most effective measure is to replace the copper pennies with a coin that would not be hoarded for its metal content by the public, but would remain in circulation to serve the needs of our Nation's commerce and trade.

While it is clear that it may soon be necessary to abandon the copper penny, finding a suitable replacement marerial has been a difficult task. Last July, in view of the rapidly rising copper prices, we initiated an in-depth study examining all the feasible alternatives to the bronze penny. The criteria used for evaluating alternative materials included long-term availability, cost, coinability, public acceptability, durability, effect on the coin-machine industry and energy consumption. many alloy systems and other materials investigated include the following: copper-zinc alloys, aluminum alloys, chromized steel and stainless steel, plastics, zinc-based alloys, bronze clad steel, aluminum clad steel, cupro-nickel clad zinc, stainless steel clad aluminum and nickel clad steel. An alloy system, by the way, includes a wide variety of specific compositions having different characteristics. For example, in the copper-zinc system, we studied alloys containing the following copper-zinc



percentages: 90-10; 87-13; 85-15; 70-30 and 60-40. After reviewing the merits of these alloys and other materials against the criteria of the study, copper-zinc alloys, bronze clad steel, aluminum alloys and chromized steel were chosen for more extensive evaluation.

As a result of such further thorough evaluation, we have determined that an aluminum alloy would be the most practical alternative to the bronze penny. In terms of durability and corrosion resistance, aluminum has proved to be a more than acceptable coinage metal in countries throughout the world where aluminum coins are circulating. Also, the lower weight of aluminum needed to make a penny of the same size assures that the metal cost of the penny will remain significantly lower than its face value for a long time to come. We could make about five hundred pennies out of a pound of aluminum, compared with the approximately 150 bronze pennies we can produce from one pound of copper. Thus, at the current aluminum price of 30 cents a pound, the cost of the metal in the aluminum penny would be six-hundredths of a cent or less than one-tenth of the metal cost of the present copper penny.

A major advantage of aluminum over the other materials tested is its ease of fabrication into coinage strip and coins. There are numerous domestic suppliers of aluminum strip suitable for coinage. Furthermore, aluminum strip is readily fabricated into coins. The Mint's production processes would be simplified by using aluminum and all of our coining equipment could be used to produce aluminum pennies without modification. These factors are particularly important in view of the increasing demand for pennies.

Another factor favoring aluminum as the logical replacement of copper in the pennies is the long-term assured availability of the metal. Aluminum is the most abundant metallic element in the earth's crust. At the present time, bauxite is the main source of aluminum, most of which is imported from abroad. However, unlike the case of many other metals, the United States is not limited to imported aluminum for the long run. The ultimate aluminum source is expected to be the many substitute non-bauxite ores of which the United States has vast unexploited supplies. Consequently, in case of a substantial price increase for foreign bauxite, the aluminum needs of this country could be fully supplied from domestic resources. Additionally, it should be noted that the quantity of refined aluminum required for pennics would represent a miniscule fraction — less than two-tenths of one percent — of the domestic supply.

Furthermore, although the energy required to produce one pound of raw aluminum is more than twice the energy needed to produce the same quantity of copper, the change would result in a net saving of energy. This is because one pound of aluminum ingot yields more than three times as many pennies as can be obtained from a pound of raw copper and therefore a lesser quantity of aluminum is required for the production of the same amount of pennies. Energy would also be saved during the Mint's production processes. For example, aluminum blanks can be coined without a prior softening process. We are presently expending more than 8 million kilowatt hours per year for annealing or softening bronze blanks. Aluminum pennies would render this energy requirement superfluous. Lastly, because of their lighter weight, energy and shipping costs would be additionally saved in transporting aluminum pennies from the Mints to the Federal Reserve and commercial banks.

While I would certainly not recommend changing our present penny alloy just to save money, I do wish to emphasize that the proposed change would represent a minimum saving of \$40 million a year in penny metal costs at present production levels. In subsequent years, the annual saving would increase as the demand for pennies continues to increase. This saving, in the form of increased seigniorage, would be returned to the general fund thus benefiting all our taxpayers.

Ouite obviously, the public would have to adjust to the lighter weight and different color of the new penny. However, similar experiences in other countries where such a change has taken place indicate that the public would get used to the new penny in short order and without any undue difficulty. A far more serious concern is the adverse impact aluminum pennies might have on certain segments of the Nation's coin-machine industry. We certainly do not wish to impose a hardship on any industry. To be sure, most machines which utilize pennies would require no modification in handling aluminum pennies. This is true of counting machines, change dispensing machines, parking meters and simple vending devices like bubble gum machines. On the other hand, more sophisticated vending machines which accept nickels, dimes and quarters might be subject to jamming by aluminum pennies. In recognition of this possible problem, we have been and are continuing to seek the advice of and to perform cooperative testing with manufacturers of coin rejector machines. We are doing this because the lower weight of the

aluminum pennies prevents them from dropping through the chute and there is no practical means of significantly changing the weight of aluminum. While there is no danger that these machines will eject a product when an aluminum penny is inserted, the "coin return" button would have to be pushed to clear the aluminum penny. In a small fraction of cases, blockage of the coin chute may result. This is certainly a problem but current technology does not offer an easy solution.

The problems that an aluminum penny might create for the vending machine industry could be avoided by selecting a material approximating the weight of the current bronze penny. Examples of such materials are copper-zinc alloys or bronze clad steel which, as I mentioned, we thoroughly tested in our study. However, the disadvantages of such alloys as penny materials make them less acceptable than aluminum. For example, an alloy containing 70% copper and 30% zinc is approximately the weight of the current penny and would also be acceptable from the standpoint of coinability. However, since adoption of this material would only extend the "break-even" price of pennies from \$1.20 to \$1.49 per pound of copper, it would be merely an interim measure and in the near future we would undoubtedly be in the same position as we are now. Also, since this alloy would at best be a short-term solution, pennies made of this particular material would be removed from circulation because of numismatic interest in coins having a potentially brief mintage period.

Another candidate material which would create no weight problem and which would provide reasonable seigniorage protection, is bronze clad steel. This material has, however, several disadvantages. First, its hardness compared with either copper or aluminum would require that coining dies be changed frequently. Production tests indicate that the die life of bronze clad steel would be 1/4 to 1/8 of that experienced in the coining of solid penny bronze. Furthermore, the force required to strike four coins simultaneously exceeds the rated capacity of our coining presses. This would not only significantly add to our die fabrication costs but would also reduce our coinage production capacity below the level required by present demand and seriously affect the reliability of our coining equipment. Secondly, there are a very limited number of suppliers of this material and thus competition would be minimal and long-term price stability could not be assured. Lastly, the large quantity of bronze-clad steel scrap generated during the production process could not be recycled as readily as aluminum scrap.

We are sympathetic with those who might experience some inconvenience as a result of our proposal, and we are reluctant to abandon the copper penny which has been a coin of the Nation for almost two centuries. Nevertheless, we believe it is essential that the Secretary of the Treasury have the stand-by authority to substitute an other alloy for the present copper penny. Just as in the mid-1960's, when economic factors dictated that the traditional silver coinage be changed to a base metal, we have no choice but to substitute a less expensive alloy for the copper in the penny. Accordingly, passage of this bill is needed to assure an ample and uninterrupted supply of pennies for the Nation's commerce and trade.

We are sending a copy of this letter to Representative Chalmers P. Wylie of your Subcommittee.

Sincerely yours

Mary Brooks

Director of the Mint

ses Finding of Issue than the

The Honorable
Leonor K. Sullivan, Chairman
Subcommittee on Consumer
Affairs of the Committee on
Banking and Currency
House of Representatives
Washington, D. C. 20515

# FUTURE CENT DEMAND AND MATERIALS STUDY COMMITTEE

#### February 15, 1974

The Study Committee convened in the Warner Building, at 13th and E Streets, N.W., Washington, D.C. Present at this meeting were Ms. D. Kramer and Mr. H. Hervey, Office of the Secretary of the Treasury; Mr. W. Barnes, Federal Reserve Board; and Dr. A. Goldman, Dr. G. Hunter, Ms. D. Duke, Mr. F. DeLeo, Mr. J. Doom, and Mr. W. Murphy, Bureau of the Mint.

The meeting opened with Dr. Goldman updating the committee members on the progress of the proposed legislation for the new one-cent material. The house hearings have not yet been scheduled because of other congressional matters which have higher priority. A trial production run on aluminum cents is scheduled to take place at the Philadelphia Mint in 4-6 weeks.

The remainder of the meeting dealt with the progress of the various action items due and the progress of the Study Committee in meeting its other objectives.

- 1) Ms. Kramer summarized Dr. Friedman's loss rate and circulating pool calculations study in light of the Sears survey information broken down by groups of stores in four size categories. The loss rate of 12% or 4 billion pennies per year of the current circulating pool as shown in Dr. Friedman's analysis was corraborated.
  - Dr. Goldman discussed plans for the new Denver Mint and the relationship of long range Mint capacity to demand. The new Mint will yield enough additional capacity to satisfy demand to 1985-6. Furthermore, it will be built such that the coining area can be further expanded to yield sufficient coining capacity to satisfy demand into the 1990's.
- 2) Mr. DeLeo provided the committee with the total number of uncurrent coins which are removed from circulation each year by the Fed Banks. His finding of fewer than 10 million uncurrent coins is an insignificant factor in explaining the loss rate.
- 3) Mr. Doom presented his extrapolation of the Sears Data to ascertain the percentage of the circulating pool that is made up by inventory at retail sales outlets. His findings were as follows:
  - a) The daily inventory of the one-cent pieces at Sears stores is approximately 7 million. Nationwide this extrapolates to approximately 900 million coins.

- b) Sears orders a yearly total of 215 million pennies from the commercial banks. The total for nation-wide retail outlets projects to 25 billion pennies.
- 4) The sub-committee assigned to study the feasibility of the two-cent piece as an additional denomination, chaired by Ms. Duke, presented a review of their report which was circulated on February 11, 1974.

There is presently no demand for an additional denomination, and demand would have to be generated.

Introduction of a two-cent piece, while retaining the cent, would theoretically reduce the humber of coins required to make change.

Through a small sampling of local retailers (Garfinckels, G.C. Murphy, Giant and Korvettes) it was determined that the counting and wrapping of an additional denomination would not present a serious problem. Merchants were not enthusiastic when questioned on the subject of a two-cent piece. Mr. Stull equipment changes which would be required at the Reserve Banks obtain the cost necessary to overhaul these machines and both industry officials during their forthcoming meeting.

Ms. Kramer will look into the possibility of a three-cent piece by performing an analysis of the number of coins needed to make change with a three-cent piece up to 50 cents. Her findings will be presented at the next Study Committee meeting.

A question was raised as to the credibility of the total number of pennies ordered from commercial banks by nationwide retail outlets. Ms. Duke will contact Mr. Patton of Sears to determine if the date on which the survey was made is considered typical by Sears officials.

Ms. Kramer will recontact the Garfinckels, G.C. Murphy, Giant and Korvettes stores to determine their annual sales and how many pennies are ordered from commercial banks per week.

Mr. DeLeo and Mr. Barnes will contact by March 1 the six largest Fed Banks to determine how many penmies are returned per week and who are the largest depositors of these pennies. Also to be determined is the effect of the transit systems across the country on the circulating pool of one-cent pieces.

Dr. Hunter will contact the Philadelphia Transit System (SEPTA) to determine the number of pennies deposited and the frequency of deposits. The central agency of transit systems will be also contacted to determine if any overall figures are maintained.

- 5) Dr. Hunter submitted his report on the possibility of eliminating the one-cent piece. The impact of such an undertaking will probably be price increases to take advantage of rounding. This could have a serious inflationary impact.
- 6) Mr. Barnes submitted a report prepared by Mr. Stull which indicates that approximately 4 billion cents are held in savings banks. This compares with 7 billion cents in commercial banks. 85 million cents are required annually to stock new commercial banks and branches. The number of commercial banks is growing at an annual rate of approximately 2.3% and the number of branches at a rate of approximately 11.6% per annum.
- '7) Mr. Schmidt and Ms. Kramer have prepared a draft of their report on production and inventory control. It will be reviewed by a sub-committee consisting of the authors, Mr. DeLeo and Drs. Goldman and Hunter.

Dr. Goldman's office will notify all members of the committee of the time and place at least one week prior to the meeting. A report outline will be prepared by Dr. Goldman to the next meeting.

> applin Monghy February 26, 1974

OFFICIAL USE ONLY

# FUTURE CENT DEMAND AND MATERIALS STUDY COMMITTEE January 15, 1974

The Study Committee convened in the Warner Building located at 13th and E Streets, N.W., Washington, D.C. Present at this meeting were Mr. R. Schmidt, Dr. C. Friedman, Ms. D. Kramer, Office of the Secretary of the Treasury; Mr. J. Stull and Mr. W. Barnes, Federal Reserve Board; and Dr. A. Goldman, Dr. G. Hunter, Ms. D. Duke, Mr. F. DeLeo, Mr. J. Doom, and Mr. W. Murphy, Bureau of the Mint.

The meeting opened with Dr. Goldman updating the committee members on the progress of the proposed legislation for the new one-cent material. At present, this legislation has passed the Senate and is being introduced in the House where it will be subject to a hearing. Since these hearings will be critical to the passage of this legislation, the Mint has been requested to keep the report Alternative Materials for One Cent Coinage in an "Official Use Only" status.

The remainder of the meeting dealt with those objectives of the Study Committee which are nearing their estimated completion dates.

1) Demand forecast for the one-cent piece through 1990 - Dr. Friedman distributed an initial draft of his regression analysis, entitled Projection of the Demand for One-Cent Coins. While this study includes the overall totals of the Sears Survey, conducted by Ms. Duke, the complete data will be provided to Dr. Friedman by January 22, 1974 who will conduct an internal check of this material by February 5, 1974. Mr. DeLeo will also conduct a review of this data and provide the Study Committee with his analysis by the next Study Committee meeting.

Mr. Stull will also provide the total number of one-cent pieces in Savings and Loan Associations, the total number of new banks and branches, broken down by size and how many new coins are needed to stock these banks.

A major part of Dr. Friedman's analysis deals with the estimated disappearance rate of pennies from circulation since 1962. Dr. Friedman, Mr. Schmidt, and Dr. Hunter will look further into the meaning behind the term "loss rate" to determine the cause and effect relationship it has on long-range coin demand forecasting.

Mr. DeLeo and Mr. Stull will provide the Study Committee with the total number of uncurrent coins that are removed from circulation each year by the Fed Banks. Dr. Goldman will review Dr. Friedman's study in terms of the production capacity and storage capabilities of the new Denver Mint to determine whether the Mint's future expansion plans are adequate to meet coin during the 1985-1990 period.

A discussion followed concerning the alternatives available to counteract hoarding of either the 1974 bronze penny or the 1974 aluminum penny, if conditions warrant the introduction of the latter. A review will be made to determine the possibility of either dating aluminum coins with a 1975 date even if struck late in 1974 or eliminating the mint mark for one year.

The possibility of repeating the Sears Survey or reinstituting the Monthly Dating Data Survey, conducted by the Federal Reserve, for the penny one month after the introduction of the aluminum one-cent piece will be discussed during the March Study Committee meeting.

Ms. Duke will prepare a letter of appreciation to Sears Roebuck for their assistance in the survey.

- 2) Viability of a new coin denomination Ms. Duke, Mr. Stull and Ms. Kramer will meet before February 1, 1974 to determine whether an additional coin denomination between the one and five cent piece should be considered and present their findings at the next Study Committee meeting.
- 3) Production planning and inventory control Level production has been a goal of the Mint's Production Department. Such factors as the foreign coinage programs, the uncirculated coin production during January, unforecasted short-term changes in demand and occasional metal delivery and quality problems have precluded operating at as level a production posture as desired.

An inventory level can be defined such that fluctuations and coin requirements can be absorbed without major impact on production level. However, money will be required to build our present storage capacity and OMB requires a demonstration of the dollar savings of operating at level production before they will underwrite an effort to increase our inventory significantly.

Dr. Goldman will arrange a meeting between Mr. Schmidt, Ms. Kramer, Mr. Ambrose, the Mint's Assistant Director for Production, Mr. Bresnick, the Mint's Assistant Director for Administration and Mr. Pierce, the Mint's Budget and Accounting Officer to discuss the production control problem.

The next meeting of the Study Committee will be held on Tuesday, February 12, 1974 at 10:00 A.M. in the eleventh floor conference room in the Warner Building at 13th and E Streets, N.W., Washington,

W.J. Murphy/A.J. Goldman January 21, 1974

D.C.

Lacilities Project Magn.

UNITED STATES GOVERNMENT

# Memorandum

To : Mr. MacDonald

RECEIVEDDATE: January 3, 1974

FROM : M. L. Lonkay Un ++

JAN 7 1974

SUBJECT: Priority Metal Allocation

SUPERINTENDENT
U. S. MINT AT DENVER

In planning for our coinage production for the coming months. the possible need for obtaining the necessary coinage material on a priorious basis has been raised from time to time. Mr. Ambrose, in particular, may expressed concern that unless both the procurement of coinage metals from commercial sources and their transportation are treated on a national priority basis, our production schedule might suffer.

To see whether the Mint could qualify for priority treatment under existing regulatory schemes, I have looked into the various programs which provide for allocation of resources on a priority basis. However, pased on the statutes and regulations I have seen, I do not believe that we can qualify for such priority treatment.

1. Allocation of Metals. Under the Defense Production Act of 1970, the President is authorized to set priorities for purchase contracts as well as to allocate materials and facilities in the interest of national defense. The powers so granted to the President may only be utilized when the President finds that the material to be allocated is critical to the national defense and that the requirements of the national defense for succeptation on the civilian market.

The President's authority under the Act has been delegated to the cretary of Commerce. In carrying out the objectives of the Act, the ecretary has established a regulatory system under the Bureau of Domestic ommerce for the control and distribution priorities for various metals, acluding copper, aluminum and nickel alloys. In substance, this system assures that the "Claimant Agencies", which include DoD, the bree armed services, CIA, FAA, NASA and AEC, will have an adequate supply of these controlled metals for their programs.

Because of the express limitations contained in the Defense Production Act of 1950, only programs connected with the national defense are eligible for allotment. Our coinage operations, however important they may be for the national commerce and trade, cannot be considered as qualifying for this category and thus the Mint could not be included among the agencies ligible for priority allocation. The designation of Federal agencies eligible for allotment is made by the Office of Industrial Mobilization

in the Commerce Department. (See 32A CFR Chapter VI.) One of the officials of that Office (Mr. Bertsh at 189x4506), with whom I have discussed the possibility of including the Mint among such agencies. has told me that the statutory limitations would make this absolutely impossible.

2. Fuel Allocation. Both the Economic Stabilization Act, as extended on April 30, 1973, and the Emergency Petroleum Allocation Act of 1973, signed into law on November 27, 1973, authorize the President to regulate the allocation of various forms of oil and petroleum products. Persuant to these statutes, the President established by Executive Order 11748, dated December 4, 1973, the Federal Energy Office under the administration of Deputy Secretary Simon.

Effective December 27, the Federal Energy Office issued regulations providing for a comprehensive system of allocation of the various forms of oil and oil products. The Mint's coinage operations do not appear to fall within any of the priority uses but will be treated, for most purposes, as those of private business or industry. Thus, for example, our propane allocation for production purposes, a fuel which I understand is used in Philadelphia, would be 90% of our base period consumption -- meaning calendar year 1973 -- rather than 100% of our current requirements.

3. Transportation Priorities. Other than the Defense Production Act, I am not aware of any statutory authority and implementing administrative program which would set up transportation priorities for Government agencies. The Defense Production Act is drafted broadly enough to include within its mandate the priority allocation of transportation facilities in the interest of national defense. However, since as I have noted before, our activities do not come within the scope of the Act, whatever transportation priorities are established under the Act would not be available to us.

In summary, so far as I am able to tell, we are not qualified under any existing regulatory program to obtain our materials and services from private sources on a priority basis. Other than informal persuasion of our suppliers, our only remedy would be to seek legislation which would broaden the present priority allocation authority by including various governmental functions, such as coinage operations, among the programs currently limited to national defense.

cc: Mr. Ambrose

# Return to Frank OFFICIAL USE ONLY



Department of the Treasury

Alternative Materials for One Cent Coinage ALTERNATIVE MATERIALS

FOR

ONE CENT COINAGE

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DECEMBER 1973

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#### INTRODUCTION

#### Purpose

In July 1973, growing concern over both the rapidly increasing cost of copper and the rising demand for pennies compelled the Treasury Department to initiate a Treasury Department-Federal Reserve study under the direction of the Bureau of the Mint. A study committee was assigned the tasks of:

- preparing a contingency plan for an alternative metal alloy for the cent;
- (2) recommending whether a strip production or strip storage facility should be incorporated in the new Denver Mint; and
- (3) analyzing demand forecasting and production control models in order to improve the accuracy of long and short term coinage forecasts.

(See Appendix A - A Study of Future Cent Demand and Materials - Project Plan).

This report is concerned with the first two objectives of the study - namely, recommendation of a new material for the penny and a discussion of the impact of this recommendation on plans for the new Denver Mint. A subsequent report, to be issued in approximately four months, will provide recommendations on coinage demand forecasting and production control procedures.

#### Background

Approximately 75 percent of the Mint's coinage production is for one-cent coins. In 1974, the Bureau of the Mint plans to produce more than 7 1/2 billion pennies requiring approximately 50 million pounds of

copper. These 7 1/2 billion coins, worth \$75 million in terms of face value, will cost the U.S. Treasury \$66 million to produce - of which \$51 million represents the metal content at current prices. The cost of copper is threatening to increase beyond the "break-even point" for penny production and it is necessary that alternative materials for one-cent coins be seriously considered. A 95 percent copper - 5 percent zinc alloy ("penny bronze" or "gilding metal") is now utilized for pennies.

During the first eleven months of 1973, the purchase price of copper on world markets increased from 50¢ to more than \$1.00 per pound. If the price were to continue to increase to beyond \$1.20 per pound, the cost of producing the bronze 95 percent copper - 5 percent zinc cent, including material, labor and transportation costs, would exceed the value of the coin.

At a copper price of \$1.50 per pound, the intrinsic value of the metal in the coin would exceed the face value and pennies would become an inexpensive source of copper. If this situation were to occur, demand would increase drastically beyond the Mint's production capacity. The Mint would then be unable to satisfy demand at any cost and a severe coin shortage would result.

Preliminary recommendations from the study committee for an alternative coinage material were scheduled for February 1974. However, the large savings which would accrue if the cent material were changed to a less expensive alloy, coupled with a resumption in copper price increases during October 1973 after a deescalation trend in August and September, have resulted in an accelerated research and development effort, culminating in recommendations for consideration by the Director of the Mint and the Secretary of the Treasury.

#### Methodology

A list of objective criteria was prepared for assessing the suitability of alternative coinage mate-

rials. An extensive roster of possible materials was then appraised against the criteria and a small group of materials was selected for an extensive examination of metallurgical, technical and economic characteristics. A critical part of the study was a thorough exploration of the supply and demand situation for copper and those metallic elements which are important constituents of the most promising candidate materials.

Since the Mint is in the process of designing a new coining and metal strip facility to replace the present Denver Mint in 1980, it was necessary to consider the impact of a new one-cent material on plans for the new Denver Mint. Accordingly, visits were made to industrial facilities in which the most promising candidate materials are produced in the form of strip suitable for coinage blanks.

#### Acknowledgements

The study of alternate coinage materials was directed by Dr. Alan J. Goldman, Chairman of the Treasury Department - Federal Reserve Board study committee. He was assisted by Dr. George E. Hunter, C. William Smith, Jr., William J. Murphy and Richard E. Schmidt. Mark Shreeve of the Bureau of the Mint's Office of Technology performed the coining studies and assisted in the preparation of those parts of the report which concern coinability of the alternative materials.

#### SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

It is recommended that the composition of the cent be changed to an alloy containing not less than 96 percent aluminum. The size and design of the penny should not be altered. The highest feasibility materials and the present cent material are compared in Table 1. An aluminum alloy cent is preferred when compared with other candidate materials including the currently utilized 95 percent copper - 5 percent sinc alloy for the following reasons:

- 1. In recent weeks, the market price of copper has increased to more than \$1.00 per pound and the Treasury Department's seigniorage\* on one-cent coins is seriously threatened. An annual savings in raw materials exceeding \$35 million would be realized at current penny production levels if an aluminum alloy were used for one-cent coins. This saving is based on market prices for copper and aluminum of \$0.90 and \$0.30 per pound respectively.
- 2. Aluminum can be more economically fabricated into one-cent coins at an annual savings in manufacturing and transportation costs of more than \$500,000. Most of this savings is a result of the fact that coin blanks punched from aluminum strip do not require a high temperature softening treatment prior to coining.
  - \*Seigniorage represents income to the U.S. Treasury resulting from transfer, at face value, of coins from the Mint to the Federal Reserve. Its value is the difference between face value and metal cost.

- 3. The outlook for future supplies of refined aluminum and aluminum alloy strip in the United States is favorable. Furthermore, a change in penny material would have a negligible impact on the aluminum and copper alloy strip markets. The Mint would utilize less than 0.5 percent of the total aluminum alloy strip fabricated in the United States. The strip now purchased for bronze cents represents approximately one percent of the copper alloy strip produced domestically.
- 4. Aluminum coins have been accepted by the public in several developed countries including Italy, Japan, Austria, and Finland. The composition of the Finnish one pennicoin was changed from bronze to aluminum without any problem of public acceptance.
- 5. Aluminum cents of the same size as the bronze cent will not cause difficulties to users and manufacturers of coin counting, dispensing, wrapping and simple vending devices such as bubblegum machines. Sophisticated vending machines which accept and discharge cents and automatic toll booth systems which accept pennies will require some modification.
- 6. The wear-corrosion characteristics of aluminum compare very favorably with 95 percent copper - 5 percent zinc and other substitute materials which were studied.

It is recommended that the change to aluminum be effected as soon as possible in order that the Mint's production capacity not be strained by a penny shortage. A rapid, large scale withdrawal of cents from circulation is probable if the price of copper continues to rise toward a level where one-cent coins become an economically attractive source of copper.

Accordingly, draft legislation has been prepared which, if it is enacted by Congress, would give the Secretary of the Treasury the authority to change the one-cent material to an alloy containing not less than 96 percent aluminum.

In keeping with the Bureau of the Mint's policy of having the capability of producing a large percentage of its required metal strip in-house, it is recommended that a facility for casting and rolling aluminum alloy strip be included in plans for the new Denver Mint.

#### Cost of Raw Materials

From 1959 through 1963 the value of the raw materials in the 95 percent copper and 5 percent zinc penny remained approximately constant at 0.20¢ per piece or approximately 1/5 the face value of the coin. An escalation in copper prices occurred in 1964 and, although large fluctuations occurred in the price of copper during the period 1964 to 1970, the average annual value of the metal cost in the cent fluctuated in the range of 0.28¢ to 0.47¢ per piece in the period 1964 to 1972. The trend is indicated in Figure 1 where the annual average copper price and the metal value of the cent are shown for the period 1959-1972.

Biweekly average prices for copper and the metal value of the cent for the first eleven months of 1973 are indicated in Figure 2. The generally escalating trend to a metal value exceeding 0.60¢ per piece in July 1973 resulted in the formation of a study committee to seek alternative materials in case the price of copper continued to increase at a rapid rate. The intrinsic value of the metal in the cent will exceed the face value of the cent at a copper price of \$1.50 per pound.

#### Other Costs

Other costs incurred in the production of cents by the Bureau of the Mint, in addition to the cost of raw materials, include: (1) Manufacturing costs to fabricate bronze strip and coins; (2) Transportation charges for shipping raw materials and finished coins; and (3) Broker profits on the purchase of copper on world markets. The total of these costs is approximately 0.20¢ per piece or \$0.30 per pound with item (1) accounting for approximately 85 percent of these totals. It should be noted that these costs are in-

creasing at an annual rate which exceeds 5 percent.

The "break-even" point for the production of bronze cents is, therefore, \$1.20 per pound for copper (0.8¢ per piece for metal). At prices above this level, the total cost to produce a penny, including metal content, would exceed the face value of the coin.

### Factors Influencing Present Copper Market

Soaring demand and severe production, economic, technical and political dislocations in copper producing countries such as Chile and Zambia have resulted in a shortfall between supply and demand of 350,000 to 450,000 tons of copper in world markets in the third quarter of 1973 . An economic slowdown is projected for certain parts of the world economy in 1974. This is likely to cause a decrease in the rate of growth of free world copper consumption. However, a majority of the labor contracts in United States copper mining firms and copper alloy fabricators expire in mid-1974 and this will probably result in vigorous hedge buying for the next several months.

Industrial leaders at a recent forum in London predicted that the world price for refined copper would rise to \$1.05 per pound in the next two months. Approximately two weeks after the prediction was made, the market price of copper reached \$1.05. It is evident that the government must be prepared for the possibility that cents will be produced at a cost which exceeds the face value of the coin unless a cheaper material is substituted for the bronze alloy which is currently being used.

<sup>1,2</sup> A list of references may be found on page 50.

The essential function of a coin is to act as a reliable medium of exchange. Several criteria must be considered when selecting a coinage material. relative importance of the criteria set forth below are dependent, to a large extent, on the fact that this study is concerned only with the lowest value denomination, the cent. Factors such as counterfeiting potential, which are of primary importance when considering higher value coinage, are relegated to secondary importance in evaluating alternative materials for the cent. On the other hand, pennies account for approximately 75 percent of the Bureau of the Mint's production as measured by number of pieces and approximately 65 percent of the Mint's utilization of raw materials. This dictates that raw materials cost, availability, and ease of production be criteria of primary importance. With this perspective, specific criteria are reviewed below.

#### Cost, Availability and Permanence

The coinage material should be consistent with the gaals of minimizing cost to the public and maximizing Treasury "profit" (seigniorage). The intrinsic value of the metal should be significantly less than the face value of the coin in order to provide a margin of safety for future increases in the price of the raw material.

In order to assure an adequate present and future supply of the coinage material, it is imperative that ores and refined metals be available from domestic or reliable foreign sources. It would certainly be imprudent to depend on a foreign source for raw materials if there were a strong indication that supplies might be interrupted because of a threat of expropriation, revolution, strikes or other unsettling factors.

For price stability, minimal market disruption and reasonable assurance of a reliable supply of rolled strip from domestic sources are essential. Commercial production of the coinage alloy should be many times greater than Mint requirements.

Coinage materials must be available at acceptable costs for a minimum of 15 years since there is a risk of a coin shortage each time the value of the raw material approaches the face value of the coin. A shortage due to withdrawal of coins from circulation cannot be alleviated immediately by changing materials. Coin shortages are remedied only after the entire circulating pool has been replenished and this may take one to five years. In addition, changes in coinage materials occurring more frequently than 15 to 20 years may require substantial capital investment in Mint plant and equipment.

Energy consumption in the production of various materials affects their costs and availability and must also be considered.

In summary, the substitute one-cent material should be readily available for several years at a cost which will guarantee that pennies will not become a desirable source of an expensive, scarce raw material.

#### Minting Characteristics and Coining Costs

Relative ease in the manufacturing processes for a new one-cent piece is particularly desirable in view of the fact that cent production accounts for three quarters of the Mint's coinage output. In order to minimize the possibility of a cent shortage without expending large sums for new processing machinery, the selected substitute material must be readily fabricated into pennies using equipment which is presently in operation at the Bureau of the Mint's coining facilities.

It is also desirable, as a simple matter of efficiency, to minimize the cost of manufacturing coins of acceptable quality. It is axiomatic that the Treasury should seek to achieve the lowest possible total coinage cost, inclusive of materials used. This dictates that the substitute material be one which results in minimum material costs, strip fabrication costs, minting costs and transportation costs. At the same time the new material must result in a one-cent piece which is acceptable to the public.

#### Public Acceptability

The main elements of acceptability will be (a) demonstrated necessity of the change, (b) characteristics of the new coins, (c) degree of inconvenience to which the public is subjected by the change, and (d) the absence of extreme hardship suffered by any particular industry as a result of the change.

#### a. Need for the change

In view of the rapidly rising price of copper, present and prospective, and the threat that production costs for cents (inclusive of raw materials cost) will exceed the face value of the coin in the near future, it is essential that a less expensive coinage material be substituted for the 95 percent copper - 5 percent zinc alloy.

#### b. Characteristics of the new coins

The new coins should be durable, easily distinguished from the other denominations and be made of a non-toxic material. The coins must have an attractive, lustrous appearance. A history of acceptance of a similar alloy for coinage in highly developed foreign countries is considered a positive factor. Color and "feel" are not essential to the transactional function of the cent and consequently are less important characteristics. Counterfeiting potential is another property of secondary importance because of the low value of the cent and its minor importance in vending machine usage compared with other denominations.

#### c. Degree of inconvenience

Inconvenience to the public will be minimal if new coins have the desirable technical characteristics, are readily available and can be used in the small proportion of coin operated devices which accept cents. A smooth transition can best be facilitated if both the old and new coins are permitted to circulate freely without any requirement that the public exchange old coins for new.

#### d. Absence of extreme hardship

A new coinage material must not inflict a demonstrably serious hardship on a particular group or industry. The coin machine industry could claim a hardship if new coins did not work in its machines. Cents are used in counting, sorting, and coin-wrapping machines, some toll booths and vending machines, change-makers, parking meters, and cash register dispensers. Any new material cent must be useful in most of the present machines. It is desirable that very few, if any, modifications be required to avoid machine obsolescence. For this reason, changes in diameter or thickness of cents were dismissed from further consideration.

New coins and old coins must be able to be used indiscriminately in most machines, i.e. the new must not be inherently incompatible with the old.

A description of coin machine operations is given below.

(i) Counting and wrapping machines accept loose coin of any one denomination, pass it rapidly through a small turnstile for count, and drop it into a tube or bag for

wrapping. Electro-optical counting has just been introduced by two manufacturers.

- (ii) Sorting and counting machines accept loose coin of several denominations, separate it by denomination, and count numbers of coins of each denomination. There are two common types: drum and rail. The rail type is faster but requires a separate counting machine for each denomination. Both are in common use.
- (iii) Most vending machines which accept cents are of the simple bolt or wheel type found on bubblegum machines and parking meters.

One sophisticated machine has just been introduced to accept cents and other coins, vend merchandise, and dispense cents and other coins as change. There is much disagreement within the vending machine industry as to whether this type of machine will be widely accepted.

- (iv) Most toll booths discourage the use of cents by means of "NO PENNIES" signs. This is done because cents often jam these machines by overloading the vibrating chute and allowing two coins to arrive simultaneously at the sorting module.
- (v) Change-makers dispense cents and other coins from filled tubes by means of a sliding pusher at the bottom of the tube.

#### Survey of Candidate Materials

# 1. Copper-Zinc Alloys

A wide range of common copper-zinc alloys are utilized commercially for products requiring high formability and pleasing appearance. The major effects of substituting zinc for copper are to (1) decrease the raw material cost of the alloy since the price of zinc is lower than the price of copper and (2) change the color from a red bronze at 5 percent zinc to a yellow brass at 30 percent zinc. Historically, the price of zinc has been approximately one third the price of copper. The effect of zinc content on the material cost per one-cent piece is shown in Figure 3 for both the present prices of copper and zinc and prices at which the metal value of the copper - 5 percent zinc cent reaches one-cent. At current prices, the metal value of the cent could be reduced 17 percent from approximately 0.6¢ per piece to 0.5¢ per piece by utilizing an alloy containing 70 percent copper and 30 percent zinc. At current production levels, this would represent a saving of \$8 million.

The economic benefits mentioned above resulted in the inclusion of the following copper-zinc alloys in the list of high feasibility materials for further study: 90 percent copper - 10 percent zinc, 87 percent copper - 13 percent zinc, 85 percent copper - 15 percent zinc and 70 percent copper - 30 percent zinc.

#### 2. Aluminum Alloys

Aluminum alloys are used for low denomination coins in several countries including developed industrial countries such as Italy, Japan and Austria. Eight years ago, Finland substituted an aluminum alloy for bronze in the one penni piece. The new material was accepted by the public without protest.

The savings which would be realized in raw material costs if aluminum were used for cents are very large. Figure 4 shows the annual savings in millions of dollars as a function of copper price for three

levels of cent production. The price of aluminum has fluctuated in the range of 20-30¢ per pound in recent years (See Figure 5) and a price of 30¢ was assumed for the data in Figure 4. An <u>annual</u> savings exceeding \$35 million could be realized at current production levels if the cent were made of an aluminum alloy. This annual savings is even more dramatic at anticipated future production levels.

Three aluminum alloys were chosen for further study. Table 2 shows the chemical composition of commercially pure alloy 1100 and two alloys, designated 3003 and 5052, which contain additional elements for improved hardness and wear resistance.

#### 3. Chromized Steel

Many steel coating processes have been developed to provide a wide range of desirable properties. One of these processes, chromizing, employs a high temperature treatment to form an iron-chromium alloy coating on low cost sheet steel. Chromized steel is a material having the surface characteristics of stainless steel and a price which is less than 25 percent that of penny bronze. Although chromizing is a proprietary process developed by Bethlehem Steel Corporation, the desirable surface characteristics and relatively low cost of chromized steel dictated that it be considered as an alternative cent material.

#### 4. Bronze Clad Steel

Cladding is a manufacturing process for metallurgically bonding sheet materials. The United States is now using cupro-nickel clad copper coinage for dimes, quarters, half dollars and dollars as a substitute for the traditional silver coinage.

Copper-zinc alloys clad on low cost sheet steel have been used for coins in West Germany for many years. This class of three layer clad products offers the surface characteristics of copper-zinc alloys at a reduced total cost of raw materials. A clad material

consisting of 90 percent copper - 10 percent zinc clad on both sides of mild steel was studied as candidate replacement material for penny bronze.

#### 5. Stainless Steel

Coins made of stainless steels have an attractive luster and superior resistance to wear and corrosion. However, stainless steel has two disadvantages which eliminated it from further consideration. The prices of various stainless steels are higher than any of the substitute materials mentioned above and most stainless steels are more costly than penny bronze. In addition, its hardness requires that stainless steel coins be made with very low relief of image and lettering above the coin background.

#### 6. Zinc Alloys

In 1943, zinc plated on steel was used as a substitute for penny bronze in order to conserve copper. Zinc and its alloys have a silvery appearance but oxidize to a dull gray appearance after a period of use. After ten to fifteen years of handling, zinc alloys take on an unacceptable dark gray appearance. After examining several zinc Austrian coins which had become almost black, it was decided that zinc alloys do not merit further consideration.

#### 7. Plastics

There are no known instances of the use of plastic as a coinage material and it was rejected from consideration on the basis of three factors: (1) The growing world wide shortage of petroleum derivative products has caused an inadequate supply of plastics to meet current and projected industrial demand; (2) It is highly improbable that plastic coins would be acceptable to the public; and (3) A large capital expenditure for equipment would be required to produce large quantities of plastic coins.

## Supply-Demand Trends 4-7

Availability of raw materials for at least 15 years is a requisite for substitute alloys. Furthermore, materials must be obtainable at prices which will insure that frequent changes in materials will not be required to protect seigniorage. As a result, the supply-demand characteristics of elements which constitute the candidate materials were reviewed in detail. Table 3 summarizes the domestic and world production and usage of aluminum, copper, iron, zinc, chromium, magnesium and manganese. Copper, aluminum and iron are major ingredients and the remainder are minor constituents of the materials under consideration as substitutes for gilding metal. Each of the elements is discussed below in terms of the characteristics of the world and domestic markets including projections into the future.

#### Copper

The United States is the leading copper producing country in the world. In 1971 this country produced over 1.5 million short tons of copper ore which was 23 percent of the total world production. Chile, Canada and Zambia, the next three leading producers of copper ore, produced a combined total of 2.2 million short tons which was 34 percent of the total world production. In 1971 the United States produced about 1.8 million short tons of refined copper which filled over 80 percent of the domestic demand of 2.1 million short tons of refined copper.

The present consumption of copper in one-cent coins is approximately 1 percent of the total domestic consumption of the raw material. The Mint's usage of bronze strip is approximately 2 percent of the copper alloy strip produced in the United States. Only 40 percent of the bronze strip utilized for cents is purchased from copper alloy producers. The remainder is manufactured in-house at the Philadelphia and Denver Mints.

The long range projections of domestic copper demand indicate that by the year 2000 the United States will need about 7.1 million short tons of refined copper per year and that the cumulative demand from 1971 through 2000 will have been about 92.7 million short tons. Domestic reserves in the U.S. are more than adequate to meet this demand. The world demand for copper in 1972 was about 8.7 million short tons. By the year 2000 the world demand is projected to be 31.5 million tons annually and the cumulative world demand from 1971 through 2000 will have been 392.6 million short tons. In summary, both the U.S. and world reserves of copper are adequate to meet both the U.S. and world demand through the year 2000. We can, however, anticipate rising prices (in constant dollars) as the demand increases.

Prices of copper, in terms of constant 1971 dollars, increased from \$.39 per pound in 1959 to \$.52 per pound in 1971. Recently prices have risen sharply. In November 1973 the price of copper reached a level above \$1.00 per pound. This increase was due primarily to a generally buoyant economy with concurrent increases in the demand for copper. There were political problems and strikes in Chile and Peru in 1973. These conditions as well as transportation and other logistical problems in Zambia, adversely affected the supply of copper to world copper markets. The supply shortage, combined with the high level of demand, has driven prices upward.

The largest domestic use of copper is in electrical equipment and supplies. Electrical wiring, test equipment, power generation and distribution systems, sophisticated electronic navigation and communications systems require large quantities of copper. The non-corrosive properties of copper also result in many uses in the construction industries for roofing and plumbing. Copper alloys are also used extensively in the production of non-electrical machinery, in the transportation industry and in the manufacture of ordnance.

In projecting future demands, it is essential that several factors be considered. These include possible

substitution of other materials such as aluminum and aluminum clad copper for copper in some applications if the present price differential persists or increases. On the other hand, increased usage of electrical energy compared with energy generated from combustion of petroleum and its derivatives is likely to greatly increase demand for copper.

The environmental considerations in both the mining and manufacture of copper are formidable. The mining operation scars the land and surface restoration presents a major ecological problem. Because one ton of water is required per ton of ore processed, adequate water supplies must be available. During the smelting operation sulfur is emitted into the atmosphere causing air pollution. Pressures to reduce  $SO_2$  emissions at copper smelters through proposed stringent regulations are retarding decisions on needed increases in smelting capacity. These environmental problems can be solved but only at a significant increase in production costs.

Another major problem that the copper industry faces is a generally declining yield of copper from ore in the United States. The yield has dropped from an average of 18 pounds of copper per ton of ore in 1950 to 11 pounds per ton in 1971. Some copper deposits currently under development contain only 8 pounds of copper per ton of ore.

The long range projections regarding supply, demand, environmental problems, and technological advances reflect the most accurate extrapolation of data that can be made at this time. The short range projections are that the price of copper will continue to rise because many domestic copper mining and strip producer labor contracts expire in mid-1974. This will keep prices up during the next six months as consumers try to accumulate larger inventories. While the long range projections are far from absolute in determining precise economic data, the general trend seems to indicate that considering all factors the price of copper, in constant dollars, can be expected to increase.

#### 2. Aluminum

Aluminum is the most abundant metallic element in the earth's crust. Bauxite, the ore most commonly used as a source of aluminum, is found primarily in the less industralized areas of the world. The leading world producer of bauxite in 1971 was Jamaica where 2.8 million short tons were produced. Of this total, 1.7 million tons were imported into the United States. Other leading world producers were Australia (2.8 million tons) and Surinam in Northeastern South America (1.7 million tons). In 1971 the United States produced .5 million short tons of bauxite domestically, primarily in Arkansas.

The total U.S. demand for refined aluminum metal in 1971 was 4.1 million short tons. Although domestic refineries accounted for 3.9 million tons of aluminum metal which satisfied 95 percent of this demand, only 12 percent of our raw materials requirements were supplied from domestic sources.

The world demand for aluminum in 1971 was 13.3 million short tons. By the year 2000 the world demand is projected to be 81.3 million tons. World reserves are estimated at 3 to 6 billion tons and the potential world supply for at least a century is virtually unlimited. Many of the major bauxite deposits are owned by domestic firms. However, taxes and royalties on bauxite mining in foreign countries are expected to increase and since the U.S. currently depends on imports of bauxite for more than 85 percent of its requirements, domestic prices of refined aluminum can be expected to increase. Figure 5 shows that the domestic price of aluminum has varied over a very narrow range during the past 15 years.

Although bauxite is now the main aluminum resource domestically and abroad, the ultimate aluminum resources are expected to be non-bauxite clays of the kaolin type, anorthosite and alumite. The United States has large supplies of such materials and could meet all or most of its aluminum raw materials needs indefinitely if domestic firms exploit these alternate sources of aluminum. At the current price of aluminum of less than \$0.30 per pound and the availability of bauxite and alumina from

foreign sources at reasonable prices, it is economically more advantageous to import large quantities of these raw materials from Jamaica, Surinam, and Australia than develop domestic clays on a large commercial scale.

Alunite is used as an economical source of aluminum in the Soviet Union. Processing of alunite yields useful byproducts, including potassium sulfate, which may make it economically competitive to bauxite. A pilot plant to extract aluminum from alunite is being built in Utah by two domestic firms.

An anorthosite deposit, owned by Alcoa and located in Wyoming, is thought to exceed all the world's known bauxite reserves. Research and development aimed at reducing the cost of extracting aluminum metal from anorthosite and other non-bauxite aluminum containing clays is being actively pursued by the Bureau of Mines. It is not unreasonable to expect that technological advances would make it economically more attractive to extract aluminum from clays and thereby eliminate our dependence on foreign ore for aluminum.

The largest domestic use of aluminum is for building and construction items such as residential siding, mobile homes, doors, windows, roofing, curtain walls, screening, bridge and guard rails, pre-engineered structures and other bridge, street and highway uses. The transportation industry is another major consumer where aluminum is used in automobiles, trucks, railroad cars, ships, and aircraft. Aluminum is also used in virtually all types of cans and containers as well as in the electrical and communications industries. It is also used for appliances as well as industrial and agricultural machinery.

Aluminum is a durable metal that deteriorates very slowly. The recycle time for old aluminum scrap varies from a few months (for special industrial uses) to 30 years or more (for other uses such as aircraft and shipbuilding). The quantity of old scrap recycled during 1971 was approximately 5 percent of the total

demand for aluminum metal. The fact that aluminum products do not deteriorate rapidly is a mixed blessing because it poses a disposal problem. However, in recent years there have been increasing efforts by the major domestic producers to recycle discarded aluminum products. Collection centers have been established throughout the country and 0.25 million tons of aluminum were recovered in 1971 from old scrap.

There are environmental problems associated with the production of aluminum. The disposal of solid wastes (red muds) generated in producing alumina from bauxite results in the creation of large red mud lakes. Fluorine-containing dust and gases emitted from the electrolytic refining process pollute both the surrounding water and air. Careful operating procedures can minimize this source of pollution and a shift to a fluoride-free electrolyte is a possible future technological advancement.

In summary, while the domestic supply of bauxite is limited, it is very plentiful throughout the rest of the world. Other aluminum bearing ores are available in the United States and may be exploited commercially by 1980. The abundance, low price, high electrical and thermal conductivity, and durability of aluminum will result in an ever increasing demand as other metals become more costly.

#### 3. Iron

The leading world source of iron ore in 1971 was the U.S.S.R. which produced 132 million tons. This represented approximately 27 percent of the total world production of 488.4 million tons. Other significant producers were the United States (54.3 million tons), Australia (43.8 million tons), Brazil (31.5 million tons), Peoples Republic of China (30.2 million tons) and Canada (30.1 million tons).

The importance of iron to an industralized economy makes it mandatory that any highly developed country fulfill a large fraction of its requirements from dom-

estic sources. The United States is able to satisfy
75 percent of its needs from domestic sources and reclaimed scrap plays an important part in enabling the
U.S. to keep imports at a minimum. Domestic scrap
totaled 33.4 million tons in 1971. Imports totaled
28 million tons, the bulk of which was in the form of
ore (27.7 million tons). The major external sources
of iron ore are Canada and Venezuela. Domestic ore
production could be increased to meet the total domestic need, but only with a relative sacrifice in ore
quality, or increase in cost over imported ore.

The United States demand for refined pig iron in 1971 totaled 108.1 million tons while domestic production totaled 81.4 million tons. This was second only to the Soviet Union's production of 97.3 million tons of pig iron. Other leading producers of refined iron in 1971 were Japan (80.2 million tons), West Germany (32.8 million tons) and China (30 million tons). The world produced 474.2 million tons of pig iron in 1971.

The long range projections of domestic iron demand indicate that by the year 2000 the U.S. will need about 220 million tons of iron and the world total requirement will be 1,260 million tons. Domestic resources of iron ore are estimated to be 2,000 million tons and total world reserves are estimated at 96,700 million tons. While iron-bearing substances are widely distributed throughout the world, three factors are important in determining the degree to which they can be classified as ore: quality, in terms of yield of iron and prevailing extraction technology; accessibility, in terms of competitive position with regard to other available sources; and security, in terms of the extent to which supplies are insured.

Iron ore prices have been relatively stable over the last 20 years. Worldwide prices began rising somewhat in 1970 as several foreign producers obtained higher prices for future export contracts. The 1971 price of iron ore was \$17.20 per ton and the price is expected to reach \$20.30 per ton by 2000.

The average price of basic pig iron ranged from \$47.39 per ton in 1952 to \$68.68 in 1971. The October 1973 price for pig iron was \$71.15 per ton. This is equivalent to less than four cents per pound.

Approximately 90 percent of the pig iron produced is used in steel making. Most of the remainder goes to foundries to make castings, pipe, and machinery parts. The many varieties of steel are used in the production of motor vehicles, ships, railroad equipment, pipe and tubing, construction products, containers, appliances, machinery tools, cutlery, and hundreds of other miscellaneous items.

#### 4. Zinc

In 1971, the United States was the third largest producer of zinc ore in the world and the leading producer and consumer of refined zinc. Fifty percent of the total domestic imports of ore and zinc metal in 1971 were supplied by Canada which led the world in ore production. Total domestic slab zinc production in 1971 was 847 thousand short tons. This satisfied approximately 70 percent of the total domestic demand of 1,209 thousand short tons of zinc metal.

The total world production of zinc ore in 1971 was 6,078 thousand short tons with Canada, U.S.S.R., U.S. and Australia the leading producers. World zinc metal production in 1971 totaled 5,083 thousand short tons with the U.S., U.S.S.R. and Japan the leading producers.

Domestic mine production during 1971 (503 thousand short tons) was 6 percent lower than 1970 and preliminary totals for 1972 (481 thousand short tons) mine production point to a 4 percent decline from the

1971 totals. While the closure of five mines in 1972 was the primary cause for this decline, a new zinc-copper mine in Maine started operation in October of 1972. The closure of the electrolytic plant at Great Falls, Montana in 1972 caused a decline in smelter production of 150 thousand short tons. It is apparent that if this trend continues, the domestic reliance on imports will greatly increase in the future.

The long range projections of domestic zinc demand indicate that in the year 2000 the U.S. will need approximately 2,900 thousand short tons of slab zinc. Domestic reserves at the price of \$.25 per pound are estimated at about 50,000 thousand short tons. However, unless means of commercially exploiting sources that are presently classified as "marginal" are developed, domestic reserves will have been largely exhausted by 2000. Extensive potential reserves, now classified as "inferred", exist in the zinc producing areas of the United States and would undoubtedly be developed under the incentive of a growing demand accompanied by price increases. Canada's resources at a price of \$.25 per pound are 75,000 thousand short tons. more than double the total shown at the 1971 price of \$.16 per pound.

Historically, the demand for zinc correlates with the general economic activity in most areas of the world. During the 1952-1971 period the average annual price of slab zinc in constant 1971 dollars varied between 14 and 26 cents per pound. The price of zinc has, historically, been approximately one third the price of copper.

In the United States, zinc is used in zinc-based alloys (34 percent) principally for diecastings; in galvanizing (27 percent) for corrosion protection of iron and ore steel; in brass and bronze alloys (21 percent) for sheet, plate and rod; in zinc oxide (10 percent) principally for rubber, pigment, sensitizing paper for photocopying and chemicals; as rolled zinc (2 percent) for battery cases, lithographic plates and architectural application; and miscellaneous (6 per-

cent) for zinc dust, other alloys, plant and animal nutrition, rayon, wood treating, and fungicides.

An important factor which will have a significant effect on both future demand and price is substitution. Zinc competes with many alternate materials, principally aluminum and plastics, for major uses. In periods of higher zinc demand, a price advantage could favor substitution of aluminum for galvanized sheet. Plastic coatings or paint can also be used in place of galvanizing to protect steel. Both aluminum and plastics are also potential substitutes in some die casting applications and for brass products.

## 5. Manganese

Manganese occurs in nature in combination with other elements in the form of ore minerals. The primary form found in the United States is manganiferous ore with a manganese content between 10 and 35 percent. These are mainly produced as a coproduct of iron and zinc. Manganese ore, a second form, is no longer a domestic source of supply because the cost of mining and treating these ores to produce a product equal in quality to the imported ores is higher than the delivered value of the foreign ores. Currently under study is a third form derived from sea nodules in the Pacific Ocean.

The United States depends upon imports to meet 95 percent of its domestic requirements. These imports are principally in the form of ore but are also in the form of ferroalloys. Major suppliers to the U.S. in 1972 were Gabon (26 percent), Brazil (19 percent), Republic of South Africa (15 percent) and Zaire (10 percent). With political unrest a future possibility in some of these countries, it is expected that the U.S. will depend upon Australia, India, Brazil and the Republic of South Africa to fulfill the large proportion of its future needs. Since manganese resources are distributed in a relatively large number of countries, sources of supply

do not appear to be a future problem.

During 1972, the United States demand totaled 1.26 million tons of manganese. Imports of 1.20 million tons, domestic production of .03 million tons and reclaimed scrap were used to meet this demand. A 1970 study conducted by the Bureau of Mines forecasts the U.S. demand in 2000 to be 2.1 million tons and the cumulative total from 1968 to 2000 to be between 47 and 53 million tons. The study also predicts that the rest of the world will need 18.3 million tons to meet its requirements in 2000 and the cumulative total from 1968 to 2000 will be between 335 and 407 million tons. With world reserves listed at 646 million tons there appear to be no foreseeable problems concerning a shortage of supply during the next 30 years.

Prices of manganese ores depend upon variable factors such as manganese content, chemical analysis and physical structure of the ore, quantity purchased and delivery costs such as freight and insurance. Prices of manganese ferroalloys vary according to the amount of contained manganese; content of carbon, silicon, and phosphorous; the physical sizes of the materials; and the quantity sold.

The 1970 Bureau of Mines study pointed out that the steady decline in price from more than \$200 to \$55 per short ton in the period from 1957 to 1968 was due to the increase in supply caused by the development of new deposits in Brazil, Australia, and several countries of Africa. Since supply is expected to remain approximately equal to demand, the price should remain constant through 2000. This is equivalent to less than three cents per pound. Refined manganese is priced at 35 cents per pound.

While the United States must rely heavily upon foreign sources to fulfill its demand in the future, the distribution of resources throughout the world, a more than adequate supply in relation to expected world demand and increasing competition among a large number of producing countries are factors that point

to a favorable picture concerning the price and availability of manganese through 2000.

Manganese ore is used in the United States chiefly for the production of ferroalloys, most of which is consumed by iron and steel plants throughout the U.S. Used chiefly as a desulfurizing agent in steel making, manganese also improves the rolling and forging characteristics of steel and adds to the strength, toughness, wear-resistance, hardness, and hardenability. Manganese is also added as a desulfurizing agent in the production of copper-nickel alloys and as a alloying addition to aluminum. Other areas of use include drycell batteries and manganese compounds for chemical processing.

# 6. Magnesium

Magnesium is the third most abundant structural element in the earth's crust. Commercial sources of magnesium raw material are widespread throughout the world and are so large that a tenfold increase in world demand would have little long run effect on availability or price.

About 90 percent of the magnesium consumed in the United States is in the nonmetallic form, mostly in high temperature refractories, pharmaceuticals, and in oxychloride and oxysulfate cements. Principal uses for the metal include the production of aluminum alloys and ductile iron, as a reducing agent for titanium and other metals, and for cathodic protection devices.

Two primary methods are employed to produce magnesium in the United States: The electrolysis of magnesium chloride from sea water, and the thermic reduction of dolomite with ferrosilicon. Dolomite, the double carbonate of magnesium and calcium and a sedimentary rock commonly imbedded with limestone, extends over large areas of the United States.

As of 1972 there were two domestic producers of magnesium metal and another company planning to enter

the business in 1973. One company in Texas uses sea water as its raw material source. The raw material source for the company located in Utah is the brine of the Great Salt Lake.

In 1971 the United States produced 123,000 tons of refined magnesium, the highest in the world where the total output was 257,000 tons. The U.S. and Norway are the primary consumers of refined magnesium metal. The former uses 99,000 tons and the latter 155,000 tons. The U.S. is a net exporter of magnesium metal.

World reserves of magnesium in magnesite are estimated to be over 2.6 million tons. World dolomite reserves are vast, and resources of lake and well brines are extensive. Sea water is available in virtually unlimited quantities in nearly all countries. It contains approximately 0.13 percent magnesium and is continuously replenished by drainage from land masses. All magnesium compounds and the metal can be extracted from sea water.

The present price for magnesium metal is approximately 38 cents per pound. This is only slightly higher than the 35.25 cent price which persisted from 1968 to 1970. Low cost electric power is a major contributing factor in the location of magnesium reduction plants and a 1970 report for the Bonneville Power Administration estimated that a pound of magnesium can be produced on the Texas gulf coast from sea water at an average operating cost of 21.7 cents.

A Department of Commerce study projects the domestic demand for magnesium metal in 2000 to be 460,000 tons equal to a 4.7 percent annual growth rate based on the 1968 demand of 106,000 tons. The forecast projects U.S. demand will be approximately one half of the total world demand as is the current trend.

Future technology will bring major improvements and new developments in magnesium extraction and fabricating techniques, and magnesium alloys.

The United States is expected to continue to provide virtually all of its needs for primary magnesium to meet the high or low forecast demand ranges for metal and nonmetal applications. A major factor in future supply-demand relationships for magnesium metal is the future price of aluminum since magnesium based alloys may be substituted for aluminum based alloys in some applications requiring light weight and moderate strength. More electric energy per unit of production is used in making magnesium than is required to make aluminum, and the long-term downtrend in the cost of electrical energy relative to other energy sources, services and products foreshadows a possible decline in the cost of magnesium compared with that of aluminum and other metals.

## 7. Chromium

The United States relies entirely on imports to meet its chromium requirements. The certainty of supply in a number of instances is speculative. The most urgent problem is establishing appropriate international relationships with regard to this commodity.

The importation of chromite from Rhodesia was resumed during 1972 although United Nations sanctions continued. Imports of chromium alloys reached a record high of 140,000 tons equivalent to 350,000 tons of chromite. As a result of this level of imports, domestic production of alloys containing chromium was about the same as in 1971, despite a significantly higher demand for chromium in alloys.

Domestic production of chromite ceased in 1961 when the last Government contract under the Defense Production Act was concluded. Since domestic ore is low grade it cannot compete with imported ore unless the price is above 15 cents per pound. Currently under development is a more direct means of using under grade chromite in the production of stainless steel. This may be a factor in lowering unit costs

and increasing supply.

Government intervention has had a significant effect on the price of chromium. Stockpiling during the 50's drove the average price to above 10 cents per pound but at the conclusion of the program in 1967 the price dropped to 7 cents.

United States reserves at the 1971 price of 8 cents per pound are listed as zero while the world resources are 132 million tons. Domestic reserves which can be economically processed at a price of 15 cents per pound are listed at 670,000 tons.

In 1971 the United States consumed 0.4 million tons of the world total of 2.1 million tons. The U.S.S.R. and other communist block countries mined 39 percent of the world total of 2.2 million tons.

Estimated world reserves are more than adequate to meet both the probable and high forecast ranges for world demand in the near future.

As a pure metal and as a ferroalloy, chromium is used in the manufacture of stainless, tool and alloy steels, superalloys, cast iron, and nonferrous alloys; for refractory purposes, as chromite, for steel and glass manufacturing furnaces; and as a foundry sand. Major uses as a chemical include pigment manufacture, leather tanning, mordants and dyes, and electroplating. Consumption in 1971 by more than 1,000 firms was in: construction materials, 22 percent; transportation equipment, 21 percent; refractories, 13 percent; machinery, 13 percent; and other, 31 percent.

United States demand will be largely contingent on the level of steel production since chromium is a major alloying addition to stainless and other alloy steels.

# Consideration of High Feasibility Materials

# 1. Copper-Zinc Alloys

Bronze alloys 220 (90 percent copper - 10 percent zinc) and 226 (87 percent copper - 13 percent zinc), red brass alloy 230 (85 percent copper - 15 percent zinc), and yellow cartridge brass alloy 260 (70 percent copper - 30 percent zinc) were tested as possible alternatives to 95 percent copper - 5 percent zinc gilding metal (penny bronze).

The experimental coining procedures are detailed in Appendix C. The alloys were blanked from strip without difficulty. A softening treatment prior to coining is necessary for any of these alloys. The temperature and time required to soften the blanks is greater as zinc content is increased beyond 5 percent. (See Annealing Summary - Table 4) As a result the annealing treatment for any of the experimental alloys would be more costly than for gilding metal blanks.

After annealing, all of the alloys responded to the cleaning treatment except alloy 260 which retained an orange-green appearance. The color resulted from dezincification of the surface - that is, zinc volatilizing from the surface of the blanks due to the high temperature. The other alloys assumed progressively lighter shades of red-orange compared with gilding metal, as zinc content increased to 15 percent.

The coining forces required to fill the image details of the experimental dies were similar to penny bronze for the 90 percent copper - 10 percent zinc and 87 percent copper - 13 percent zinc alloys. For 85 percent copper - 15 percent zinc and 70 percent copper - 30 percent zinc, coining forces were higher than those required for penny bronze (See Figure 5). This would cause increased die wear and an increased incidence of die cracking if either of these latter two alloys were substituted for penny bronze.

Wear-corrosion tests (See Appendix D for test description) show that resistance to surface deterioration increases with increasing zinc content. Higher zinc alloys are harder than the present cent alloy and should be slightly more resistant to nicking and scratches. All of the copper-zinc alloys tarnish rapidly.

All machines which utilize cents require no modification for higher zinc brass cents either alone or in combination with present cents.

It should also be noted that 70 percent copper - 30 percent zinc is more difficult to process to strip form than penny bronze. The higher zinc content and the high volatility of zinc mentioned above would create more difficult melting and casting conditions. This could create environmental problems for the workers and would require an extensive fume control system for the exhausts above the melting and casting facilities.

The selection of a higher zinc, copper-zinc alloy, must be regarded as a "holding action" rather than a solution to the current problem. Figure 3 indicates that the raw materials savings resulting from increasing zinc content are small. The financial benefits would probably provide only a temporary respite before the increasing price of copper necessitated that a second change be made. Furthermore, coin and strip fabrication costs are likely to increase slightly as a result of increased coining pressures and zinc volatilization.

Conclusion: Rejected as possible coining alloys.

Reasons: Lack of sufficient long range seigniorage protection against further increases in the price of copper, probable increase in manufacturing costs.

## 2. Aluminum Alloys

Aluminum alloys 1100, 3003, and 5052 have been tested for possible use as a substitute for the 95 percent copper - 5 percent zinc bronze presently used for the penny. The nominal compositions of the three alloys are summarized in Table 2. Alloy 3003 is the most readily available commercial aluminum alloy and is hardened by manganese. Alloy 5052 is representative of aluminum-magnesium alloys.

The three alloys were blanked from the strip without difficulty. Blanks of alloys 1100 and 3003 require no softening treatment prior to coining. Annealing of bronze one-cent blanks in FY 1973 cost the Mint approximately \$500,000. Alloy 5052 requires a low temperature annealing treatment to soften the blanks in order to reduce the force required for coining.

In the experimental study, the necessity for blank cleaning was minimal. An alcohol rub to remove grease, metal fines and dirt was satisfactory. It may be possible to purchase clean, degreased, strip at a very small premium (less than one cent per pound for cleaning). If not, an alkaline or solvent degrease in standard Mint blank cleaning equipment can be accomplished at a lower cost than is incurred in cleaning annealed bronze blanks.

There are other important advantages of aluminum alloys, aside from the annual multi-million dollar savings in metal cost and significant savings in annealing and cleaning costs. First, the metal value in the cent would be less than 0.1¢ (Figure 4). This provides a very large margin of safety for future metal price increases. Another significant advantage is the low coining force required to fill the image details of coin dies (See Figure 6). This could result in reduced die wear, fewer cracked dies and, quite possibly, extended die life. Alloy 5052 would require a low temperature annealing treatment since the coining pressures

required for complete die fill are higher than those for penny bronze. Aluminum-magnesium alloys containing no chromium and, perhaps, less magnesium than 5052 are more readily coined without an annealing treatment.

A minor problem arose due to the easy metal flow characteristics of aluminum. Finning, or the appearance of a wire edge caused by material extruding between the die and collar, was initially observed prior to complete fill of the experimental dies. Finning is most severe on the softest material, alloy 1100, and this alloy was, therefore, eliminated from further consideration. This situation was greatly alleviated on alloys 3003 and 5052 using 1974 cent dies which have a slightly wider border than the experimental dies. Further studies using the 1974 cent dies indicated that the use of a ten cent upset segment to move metal away from the edge of the blank, prior to coining, eliminates this problem.

It may be necessary to reduce coining press speed slightly due to the weight of the aluminum blanks. Since the aluminum blanks are light, they are slightly more difficult to feed into the coining presses. Although a limit on press speed will have to be found experimentally, the presses may have to be run at speeds of 110-120 strokes per minute compared with 120-130 strokes per minute for bronze. Large quantities of aluminum alloy 3003 strip have been procured so that extensive tests can be performed to determine optimum press speeds. The increased cost resulting from a slight decrease in press speed is minimal compared with the potential savings in raw materials (Figure 4) and the savings which will result from the elimination of the coin blank softening treatment.

Although alloys 3003 and 5052 were both successfully coined into pennies and are readily available from several commercial sources, a series of aluminum-

magnesium alloys containing 0.8, 1.4, 1.8 and 2.5 percent magnesium are now being evaluated in order to determine which is the optimum alloy for coinage. These materials are not as hard as alloy 5052 and do not require a softening treatment prior to coining. Aluminum-magnesium alloys are somewhat easier to fabricate into strip than an aluminum-manganese alloy such as 3003. If a strip fabrication facility is to be included in the new Denver Mint, it is important that aluminum-magnesium alloys be thoroughly investigated before a final decision is reached on selection of the optimum aluminum alloy for coinage.

Because aluminum alloys form a natural protective oxide coating, they showed far better wear-corrosion characteristics than the present gilding metal alloy. Accelerated wear-corrosion tests (See Appendix D) which caused present pieces to lose 0.160 percent of their weight caused aluminum losses of only 0.012 to 0.038 percent, depending on the aluminum alloy chosen. This would correspond to a life four to seven times as long as the present cent alloy. This will be reduced somewhat by aluminum's greater susceptibility to scratches, nicks, and deformation. Considering all of these factors, durability is certainly acceptable.

It has been suggested that the color of aluminum would cause confusion when several coins are viewed on edge in a purse or pouch. Coloring the aluminum coin by anodizing was suggested as an alternative. The suggestion is not economically feasible. An aluminum cent would not have the orange colored edge nor the reeded pattern of the dime. The weight of the cent would be only 20 percent that of the five cent piece and, in time, the public will readily distinguish between the colors of aluminum and cupro-nickel. The latter is considerably grayer in appearance. Several countries, including Japan, Spain, and Poland, use coins of cupro-nickel and aluminum in sizes which are closer to one another than the U.S. cent is to the

nickel. If an aluminum alloy is selected for the penny, there is not expected to be any problem in distinguishing the cent from the dime or nickel.

Most machines which utilize cents require no modification to utilize aluminum cents alone or in combination with present cents. This is true of counting machines, cash registers, change dispensing machines, parking meters, and simple vending devices like bubblegum machines.

Sophisticated vending devices and automatic toll booth systems will require modification to accept aluminum cents, primarily because the low weight is not sufficient to trigger certain microswitches in these machines. These microswitches would have to be replaced by electro-optical switches (probably Light-Emitting-Diodes, LED's) which cost about \$20 each plus installation. In addition, the present odd-cent machines would require replacement of the entire acceptor mechanism because of their choice of weight rather than diameter for the preliminary separation of dimes and cents.

This is not an extreme hardship for either the purchasers or manufacturers of vending machines. Both industries do almost all their business in higher denomination equipment. Odd-cent pricing is still controversial and very few odd-cent vending machines are in use at the present time.

Automatic toll booths are serviced almost daily by manufacturer's representatives. Installation of LED switches on these machines could be accomplished as part of routine service visits. This would not be an extreme hardship for either the transit authorities or the automatic toll booth manufacturers. After modification, the toll booths would accept both bronze and aluminum cents.

The aluminum metal industry is a large consumer of electrical energy. The average aluminum refinery utilizes 8 kilowatt hours per pound of metallic aluminum and the total industry usage of 70 billion kilowatt hours in 1971 was approximately 4 percent of the total electrical energy used in the U.S. On the basis of total energy consumed considering all energy inputs - electrical, thermal and others including petroleum rich products consumed in the production processes - the aluminum industry accounts for 1 percent of the nation's total energy usage. Steel production requires almost 3 percent of the nation's total energy.

In 1940 the average refinery required 12 kilowatt hours per pound of aluminum. Today, the most modern smelters use about 6.5 kilowatt hours for the electrolytic reduction of aluminum oxide to extract one pound of metallic aluminum. A new commercial plant scheduled for completion in 1975 is expected, on the basis of preliminary testing, to produce a pound of aluminum with only 4.5 kilowatt hours of electricity.

Copper can be produced with one kilowatt hour of electrical energy per pound. However, because of aluminum's lighter weight, a given quantity of aluminum will yield 3.4 times more of the finished product than the same quantity of copper. On the basis of number of units of finished product. the ratio of electrical energy consumed in the production of aluminum compared with copper is now approximately 2/1 and is expected to decrease to 1.3/1.

In another respect, aluminum is an energy saving metal. Lighter vehicles, whether a truck, railroad car or airplane, mean less fuel consumption. The energy saved from the use of aluminum in vehicles comes primarily from petroleum which is likely to remain in short supply. On the other hand, domestic

coal, gas and hydropower are required to generate the electrical power to make aluminum. These have a better future supply outlook than petroleum.

Although several advantages and some disadvantages of aluminum alloys have been discussed, the potential savings in the annual cost of raw materials which exceeds \$35 million at present production levels, the favorable future supply and price outlook and the ease of fabricating aluminum alloys to coins are the most compelling reasons for strongly considering aluminum as a substitute material for one-cent coinage.

Conclusion: Acceptable material for onecent coinage.

Reasons: Readily fabricated into strip
and coins; favorable long
range supply outlook; annual
multi-million dollar savings
in raw materials; and has
been accepted as a coinage
material in other major industrialized countries.

# 3. Chromized Steel

Chromized steel is coated with a thin iron-chromium alloy layer. The resulting material has surface characteristics similar to a stainless steel but is available at a cost which is considerably lower than the 95 percent copper - 5 percent zinc penny bronze alloy.

Most coin handling machines which utilize cents require no modification to utilize chromized steel cents alone or in combination with present cents. This is true of counting and wrapping machines, sorting and counting machines, cash register change dispensing machines, parking meters, automatic toll booths, and simple vending devices like bubblegum machines.

Sophisticated odd-cent vending devices will require modification to accept chromized steel cents, primarily because of the magnets used in present machines. The magnets are designed to slow present cents as they move through the accept-reject mechanism and to reject steel washers, the most common slug encountered.

This is not an extreme hardship for either the purchasers or manufacturers of vending machines. Both industries do almost all their business in higher denomination equipment. Odd-cent pricing is still controversial and very few odd-cent machines are in existence at present.

Wear-corrosion tests (See Appendix D for description) indicated a probable life several times greater than the present gilding metal alloy. Although overall durability was excellent, the surface appearance after testing was mottled indicating uneven corrosion and possible discontinuities in the chromized layer. The presence of porosity in the surface layer was verified by examining cross sections of coins at high magnification.

A description of the coining experimental procedures is given in Appendix C. During the blanking operation, cupping was observed - that is, the blanks were convex in shape rather than flat. No softening treatment was performed on the material since it received a very high temperature anneal to form the iron-chromium surface layer during fabrication at Bethlehem Steel Corporation. Cleaning consisted of an alcohol rub to remove grease and dirt on the blanks. The blanks were upset using the standard penny upsetting machine.

The chromized steel is so hard that a very high pressure must be exerted to produce the proper relief on the coins. Even under the maximum safe pressure for the coining press, the relief was still not adequate (See Figure 6). This material is, therefore, unacceptable because of the expected short die life, press wear, and the inability to produce a high relief coin.

Furthermore, chromizing is a patented process of the Bethlehem Steel Corporation and the steel strip fabricating, powder rolling, diffusion annealing and auxiliary equipment would be very expensive to duplicate at a Mint facility. As a result, a reliable supply of high quality material could not be readily assured at a reasonable cost to the government.

Conclusion: Rejected as a suitable onecent material.

Reasons: Very difficult to fabricate high relief coins, uncertain supply outlook for strip.

#### 4. Bronze Clad Steel

Bronze clad steel has a similar appearance compared with bronze except for the gray edge. The material which was tested is steel coated with a layer of 90 percent copper - 10 percent zinc on each side. Gilding metal could also be used as the cladding alloy.

Cupping (blanks being bent into a convex shape) was observed during the blanking operation. The blanks will require a softening treatment at a temperature and time greater than that presently used for bronze to provide an acceptable hardness (See Table 4, page 60). Higher furnace temperature and/or slower speed through the furnace will result in higher annealing costs.

During testing, the heating cycle caused tarnishing. Hence, cleaning was necessary. The blanks were tumbled in the cleaning solution described in Appendix C for 15-20 minutes. The blanks did not clean readily so the process was repeated for a longer cleaning period. The blanks were still not clean; therefore, it is felt that another cleaning process must be found if bronze clad steel is to be used. The blanks were upset using the standard penny upsetting machine.

The coining force required to fill the experimental dies was significantly higher than any candidate alloy except chromized steel (See Figure 6, page 56). The required pressure was high enough so that a coin was not successfully produced with image and lettering completely filled even at the limitation of the available press tonnage. Without a more expensive annealing treatment to soften the steel core, the material would cause reduced die life and increased press wear. Furthermore, the image relief would probably have to be reduced even if the core were completely softened because, even at much slower speeds or higher furnace temperatures, the blanks could be not reduced in hardness to the level of annealed

gilding metal.

The economic benefits of bronze clad steel are highly questionable. The intrinsic value of the raw material would be decreased substantially compared with gilding metal but two factors tend to narrow the difference in cost. First, the cost of strip fabrication is almost 300 percent higher for the clad material compared with gilding metal. Second, gilding metal blanking scrap is readily recycled but bronze clad steel scrap has a very low recovery Table 5 shows that blank fabrication costs (including metal value) are 21 percent lower in the case of the clad material (assuming an optimistic recovery value for bronze clad steel scrap). benefit could be offset by increased blank annealing and coining costs. Furthermore, under no circumstances would the savings in raw materials costs come close to approaching the savings which the government would realize if an aluminum alloy were selected for one-cent coinage.

Most machines which utilize cents require no modification for bronze clad steel cents alone or in combination with gilding metal cents. This is true of counting and wrapping machines, sorting and counting machines, cash register change dispensing machines, parking meters, automatic toll booths, and simple vending devices like bubblegum machines. Sophisticated odd-cent vending machines will require modification to accept bronze clad steel cents because of the magnets used to slow down coins and reject steel washers.

Bronze clad steel would probably be accepted by the public in spite of the dual colored edge if the image relief did not require major reduction. Low relief copper and brass clad steel coins have been utilized in West Germany for many years and, in the United States, the cupro-nickel clad copper coins are now widely accepted.

The wear resistance of bronze clad steel coins would be approximately equal to that of the present penny. The steel edge would pit and rust slightly after many years but not to an unacceptable degree during the normal life of the cent (5-15 years).

Conclusion: Rejected as a suitable onecent material.

Reasons: Very difficult to fabricate
high relief coins; higher
strip fabrication, blank
annealing and coining costs,
and low scrap recovery value
may offset lower raw materials costs.

#### NEW DENVER MINT

## Impact of Coinage Material on Plans

In view of the high probability that the one-cent coin alloy will be changed in the near future, the Bureau of the Mint faces the following alternatives with regard to the design of the new Denver Mint.

- Proceed as planned to date. That is, construct a production facility for penny bronze strip in addition to a new coinage facility.
- 2. Proceed with site preparation and design of a new coining facility with the necessary support and administrative areas. Locate the coining facility on the site in such a manner that either a strip storage building or a strip production facility can be added as a second phase of the project.
  - 3. Hold the Denver Mint project in abeyance until legislation on a new cent material is enacted. At that time, prepare new project plan.

The second alternative is the only one which will lead to orderly planning and the completion of the project in sufficient time to meet the nation's coinage requirements in 1980. Since the nature of the strip production facility is dependent on the new one-cent material, it would be irresponsible to proceed with the design and construction of a facility for production of penny bronze strip. Similarly, it would be imprudent to delay site preparation and design of a

new coining facility. It is forecasted that total coinage demand will increase to approximately 18 billion pieces by 1980. This is 100 percent more than the current demand. Unless a new coining facility is operable in 1980, the Bureau of the Mint's coinage production capacity will be insufficient to meet demand and a coin shortage will be the likely result. It is, therefore, absolutely necessary that the design of a new coining facility proceed without delay.

Since the evaluation of substitute materials for pennies has resulted in the conclusion that an aluminum alloy is the best alternative, a review of the merits of an in-house capability to produce aluminum alloy strip for penny blanks is required to justify the substantial capital investment in plant and equipment. The Mint's recent history of heavy reliance on outside vendors as sources for coinage strip has made orderly production planning difficult.

In the past, particularly in the last year, the Mint has had intermittent problems obtaining high quality coinage metal strip on a timely basis. The Mint now manufactures approximately 40 percent of its one-cent bronze strip and purchases the remainder from commercial vendors. Considering all denominations, the Mint produces approximately 50 percent of the strip required for coinage blanks.

In Fiscal Year 1973, the Mint returned to vendors approximately one million pounds of strip which did not meet the required chemistry and quality specifications. This adversely affected production scheduling and coining costs.

Purchases of strip from commercial vendors are made on a competitive bid basis. In order for prospective bidders to offer a firm price on these invitations, the Invitation for Bid must be for a specific number of pounds, a specified delivery rate and destination, and gauge of strip. These specifications reduce the flexibility otherwise obtained by fabricating coinage strip in-house.

The purchase of coinage strip is based on the estimated demand for coins by the Federal Reserve Banks. Any changes in this demand require a corresponding adjustment in the production program. While the Mint has usually received the cooperation of strip suppliers in adjusting delivery schedules, such changes in contract, particularly changing the delivery rate, are not desirable for the contractor since they must plan their production schedules far in advance of the delivery date. In some cases it has been impossible for the contractor to decrease delivery rate and the Mint has had to accept the material and warehouse it for several months. On the other hand, a request for the contractor to increase his delivery rate due to an unforeseen surge in coin demand usually takes several weeks to accomplish, if at all. On several occasions the Mint has had to award an additional contract to obtain a higher delivery rate of strip.

The Mint has also occasionally had problems with the contractor failing to meet the required delivery date for strip. When this problem occurs, there is usually not enough lead time remaining for the Mint to award an additional contract to achieve the desired delivery date. This situation obviously causes a serious disruption in production of coins.

An intangible factor which should be considered is the possibility of labor strikes either at the commercial suppliers or by the transportation industry. The possibility of either natural calamities or changes in other product demands and requirements could affect the suppliers' ability or desire to provide the strip in a timely manner.

In recent months the commercial demand for copper alloy strip has been very high. This has resulted in

fewer competitive bids and contract awards have often been made even though one commercial firm submitted a bid. Prices are starting to increase and, if the current situation persists, the Mint will pay substantially more for strip fabricated by commercial vendors. Similar shortages of commercial strip fabricating capacity exist during high demand periods in the aluminum industry.

# Recommendations

A plant should be constructed which will allow the Mint to manufacture most of its required aluminum alloy strip in the 1980's. An in-house strip fabricating facility is necessary in order that the Mint can be assured of a constant supply of relatively high quality strip at a reasonable price.

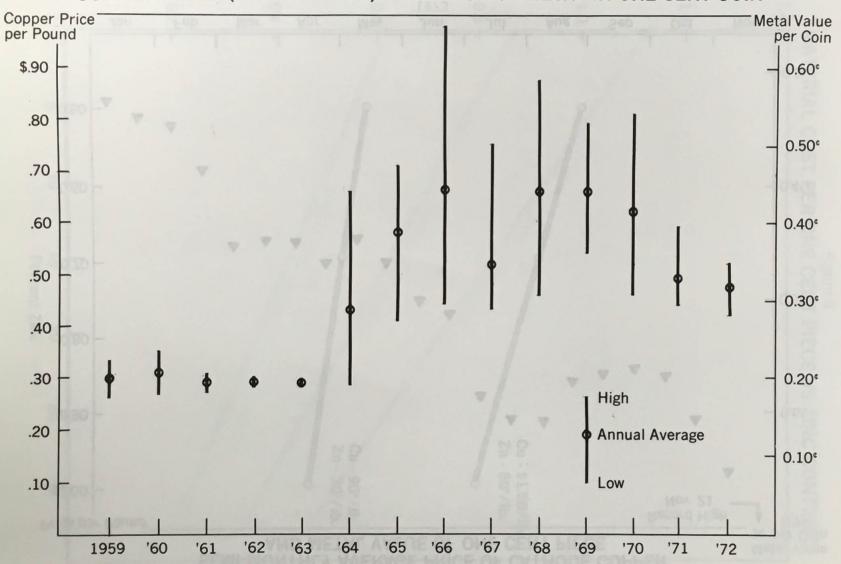
The Mint should proceed immediately with design of a coining and administrative facility for the new Denver Mint. In addition, plans should be formulated for the design and construction of a facility for the monthly production of 3.5 million pounds of aluminum strip on a three shift basis.

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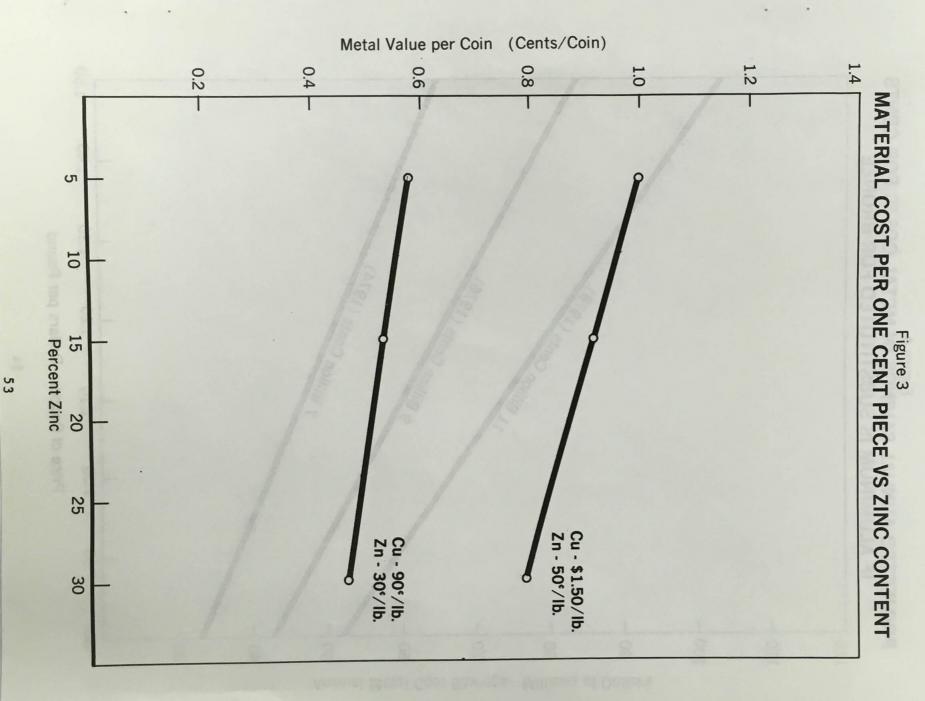


COPPER PRICES (LME CATHODE) AND VALUE OF METAL IN ONE CENT COIN

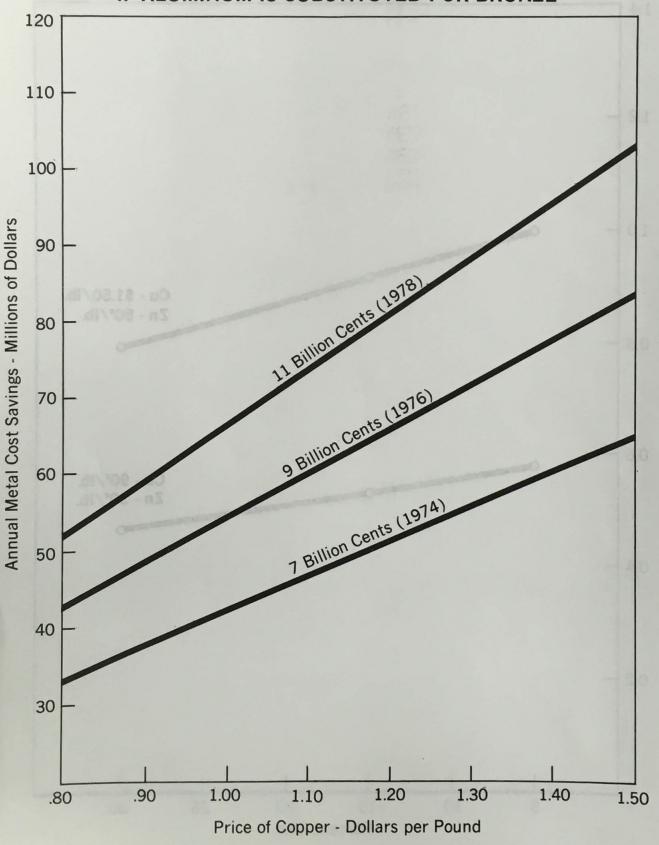


SEMI-MONTHLY AVERAGE PRICE OF CATHODE COPPER AND METAL VALUE OF ONE CENT PIECE Metal Value x per Coin Price per Pound 0.7° Record High Nov. 21 \$1.00 0.90 0.6° 0.80 0.5° 0.70 0.60 0.40 0.50 0.3 Feb Jan Mar May Apr Jul. Jun Aug Sep Oct Nov 1973

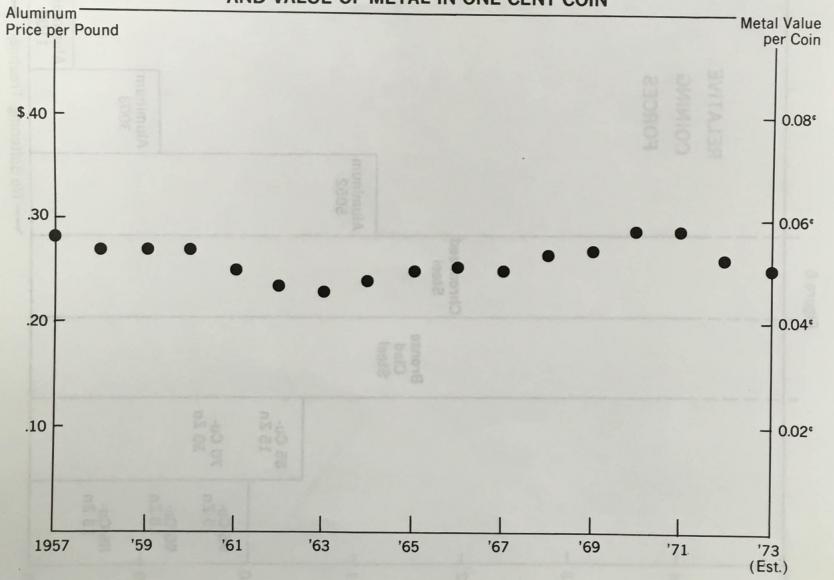
52



PROJECTED ANNUAL SAVINGS IN METAL COSTS FOR CENTS
IF ALUMINUM IS SUBSTITUTED FOR BRONZE



ANNUAL AVERAGE PRICE OF ALUMINUM INGOT AND VALUE OF METAL IN ONE CENT COIN



55

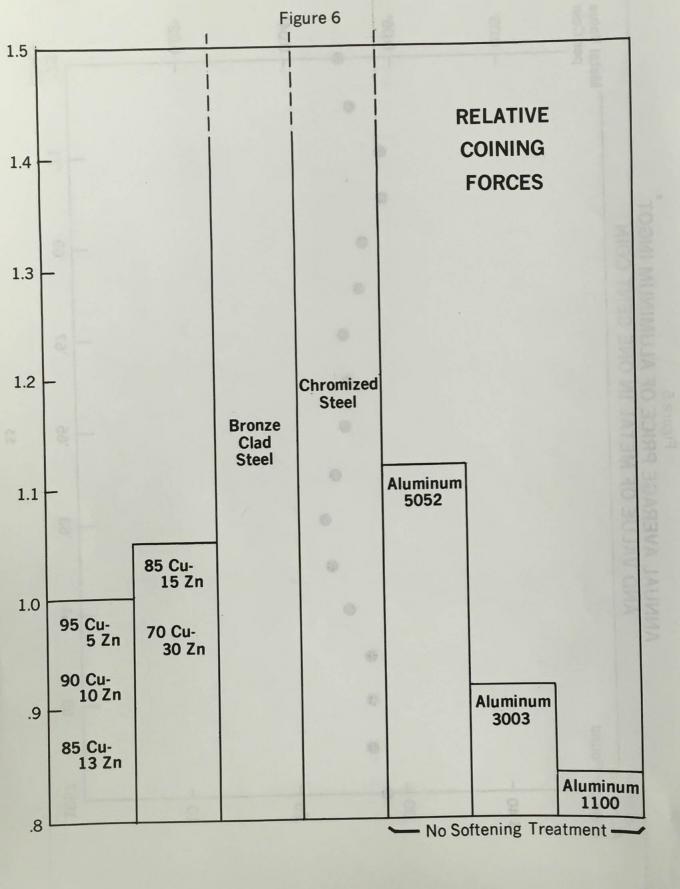




TABLE 1 - COMPARISON OF HIGH FEASIBILITY MATERIALS

			Penny Bronze	Copper - 30% Zinc	Bronze Clad Steel	Chromized Steel	Aluminum
Ease of Coin Fabrication			В	В-	x	х	A
Raw Materials and Strip Present Cost			x	c	В-	B+	A+
Present Availability			В	В	В	X	В
In-House Production Fea	asibility (1	ong range)	A	В	В	x	В
Long Range Seigniorage Pr	rotection		x	x	B+	A	A+
Public Acceptability							
General			A	B+-	B+	В	B-
Coin Machines			A	A	В	В	В-
Durability			В	В	В	A	В
AND DESCRIPTION OF THE PERSON							

A = Excellent

B = Good

C = Fair

X = Poor-Unacceptable

TABLE 2
Composition, %

<u>Alloy</u>	Aluminum*	Manganese	Magnesium	Chromium
1100	99.0 minimum			
3003	96.8 minimum	1.2		
5052	96.0 minimum		2.5	0.25

<sup>\*</sup> Small quantities of common impurities such as iron, silicon, copper and zinc may be present.

#### TABLE 3 - COMPARISON OF SUPPLY-DEMAND FACTORS (AMOUNTS IN THOUSANDS OF SHORT TONS AND REFLECTING 1971 DATE)

	Aluminum	Chromium	Copper	Iron	Magnesium 2/	Manganese 3/	Iron
	Bauxite-512	0	1,522	54,300	123	38	503
	Alumina-1315	403	181	27,700	4	1,147	467
	Bauxite: Jamaica Surinam Dom. Rep. Alumina: Australia Surinam Jamaica	So. Africa USSR Turkey Philipp.	Peru Chile So. Africa	Canada Venezuela Brazil Liberia	Canada	Gabon Brazil So. Africa Zaire	Canada Mexico Peru Honduras
Primary world producers	Jamaica Australia Surinam	USSR So. Africa Turkey Philipp.	US Chile Canada	USSR US Australia	US USSR Norway	Comm. Block So. Africa Brazil Gabon	Canada USSR US
Total world production	Bauxite-14396 Alumina-12788	2,184	6,535	488,400	257	9,998	6,078
fined Metal 4/							
Approximate price	27	33	101	4	38	35	28
per pound	4 125	(rerrochrome	2,072	108,100	938		1,209
U.S. demand		216	1,800	81,400			766
U.S. production		54	164	300			325
	Canada Norway	So. Africa	Canada Chile	Misc.	Greece Ireland	Misc.	Canada Australia
pply-Demand ojections 1/							
reserves	13,000	1,800	108,000	18,000,000	15,000	0	50,000
U.S. req. to 2000	370,000	19,100	92,700	3,200,000	43,000	47,000	62,000
Est. free world reserves (incl. U.S.) Est. cumulative free	2,405,000	771,600	379,000	141,900,000	250,000	394,000	110,000
world req. (incl. U.S.) to 2000	1,000,000	82,770	392,600	11,868,000	201,400	300,000	212,000
	Imported to U.S.  Primary suppliers to U.S.  Primary world producers  Total world production  fined Metal 4/  Approximate price per pound U.S. demand U.S. production Imported to U.S. Primary suppliers  upply-Demand rojections 1/  Estimated U.S. reserves Est. cumulative U.S. req. to 2000 Est. free world reserves (incl. U.S.) Est. cumulative fre world req. (incl.	U.S. production Imported to U.S.  Primary suppliers to U.S.  Primary suppliers to U.S.  Primary world producers  Primary world producers  Total world production  U.S. demand U.S. demand U.S. production Imported to U.S. Primary suppliers  Efined Metal 4/  Approximate price per pound U.S. demand U.S. production Imported to U.S. Primary suppliers  Canada Norway  Primary suppliers  Australia Surinam  Jamaica  Primary suppliers  Jamaica  Australia Surinam  Jamaica  Prima	U.S. production Imported to U.S. Bauxite-512	U.S. production	U.S. production	U.S. production   Bauxite-512   Downward   Downward	U.S. production   Bauxite-512   Bauxite-3029   Ba

<sup>1</sup>/ Estimated reserves are based on the highest price reported in the U.S. Industrial Outlook. As the price of metal increases the amount of potentially recoverable reserves increase.

2/ Ore quantities represent metal only; refined quantities include non-metallic totals.

 $<sup>\</sup>frac{1}{3}$ / Ore amounts represent magniferous ore for the U.S.; refined amounts represent manganese ferroalloys.

<sup>4/</sup> Difference between production plus imports compared with demand may be accounted for by scrap, industry stocks and exports.

TABLE 4 - Annealing Summary

		Hardness	es in Rocl	kwell 15T	Units	
Alloy	Gage	Before Annealing	1100°F	1200°F	1300°F	
210 Bronze	.0500 inches	88.0	46.0	45.0	43.0	
220 Bronze	.0500	88.0	54.0	50.5	49.0	
226 Bronze	.0510	89.0	56.5	52.5	51.0	
230 Brass	.0505	85.0	57.5	55.0	52.0	
260 Brass	.0500	90.0	54.0	51.5	49.5	
Bronze-Clad Steel	.0530	79.0	79.0	78.0	77.0	
Chromized Steel	.0460	72.5	72.5	72.5	72.5	
1100 Alum.	.0480	56.5	Note: A	high tem	perature	
3003 Alum.	.0485	65.0	softening treatment is not required for production			
5052 Alum.	.0500	79.0	of high relief aluminum alloy coins.			

TABLE 5 - Cost Comparison for One-Cent Blanks of Penny Bronze and Penny Bronze Clad 10% on Both Sides of Steel

	Copper-5% Zinc	Copper-5% Zinc Clad Steel
Metal Cost Strip Fabrication Cost	\$0.87 per pound 0.09	\$0.26 per pound 0.26
Gross Strip Cost	\$0.96 per pound	\$0.52 per pound
Less Scrap Value - gilding metal composite Net Cost of Blanks	- 0.44 \$0.52 per pound	-0.05 -0.02 \$0.45 per pound
Density	0.320 lbs. per inch3	0.291 lbs. per inch <sup>3</sup>
Net Cost on Volume Basis	\$0.166 per inch <sup>3</sup>	\$0.131 per inch <sup>3</sup>
Relative Cost Per Blank	1.00	0.79

## Data used in calculations

Raw material costs: Copper - \$0.90 per pound; Zinc - \$0.30 per pound; Steel - \$0.10 per pound.

Percent scrap generated in strip fabrication: Penny bronze - 28%; Penny bronze clad steel - 35%.

Percent scrap generated in blanking: Both materials - 28%.

Value of scrap: Penny bronze - 90% x metal value; Penny bronze clad steel - 20% x metal value (This may be an optimistic estimate).

#### Appendix A

# A STUDY OF FUTURE CENT DEMAND AND MATERIALS - PROJECT PLAN

# Statement of Problems

- Potential negative seigniorage and hoarding of cent.
- 2. Implications on new Denver Mint strip facility.
- Lack of satisfactory short term (as related to production scheduling and inventory requirements) and long term (as related to coining capacity requirements) demand forecasts.

#### Scope of Study

- Test and analysis of promising substitute cent materials including changes in size and copper content.
- Study of the feasibility, acceptability, and benefits and impact of an additional coin denomination between the 1¢ and 5¢ pieces.
- Analysis of the coin distribution and consumption system to improve our ability to predict short and long range coin demands.
- 4. Forecast of cent requirements for 1980-1990.
- Recommendation of strip production or storage facility for the new Denver Mint.
- 6. Recommendation for new coinage legislation.

# Methodology

- 1. Alternate cent materials and sizes.
- a. Review of potential high feasibility
  materials with respect to raw material
  availability and costs, strip and coinage production costs, ease of fabrication, acceptability, longevity, compatibility with present coinage, counter-

- feiting potential, energy consumption and vending machine use.
- b. Perform preliminary screening of available alloys and establish a priority list of high feasibility materials.
- c. Perform laboratory scale coin fabrication studies on several high feasibility mate-rials and sizes.
- d. Perform pilot scale coin fabrication studies on the most promising of the high feasibility materials and sizes above.
- e. Present samples for review and approval by Treasury and Federal Reserve System officials.

#### 2. Demand Analysis

- a. Review the coin ordering, storage, and distribution system and past bank usage data.
- b. Attempt to correlate coin usage with certain selected short and long range economic and expenditure indicators.
  - Determine the number of coins in circulation, by denomination.
  - 2. Determine the coin loss rate, particularly of cents.
- c. Perform a market analysis of the acceptability and impact of a new coin denomination on demand.
- 3. Review the impact of the above on long term coining, strip production and storage capacities.

#### Schedule

Complete laboratory scale cent alloy study, November 1, 1973. Complete pilot scale most promising alloy study, April 1, 1974.

Complete impact of new coin denomination study, January 1, 1974.

Complete cent demand study, February 1, 1974. Complete final report and recommendations, June 1, 1974.

#### Staffing

Members of the study committee will be as follows:

Bureau of the Mint
Dr. Alan J. Goldman - Chairman
Dr. George E. Hunter
William J. Murphy
Deborah A. Duke
Francis R. DeLeo

Office of the Secretary of the Treasury Richard Schmidt Homer V. Hervey C. William Smith, Jr.

Board of Governors of the Federal Reserve System James L. Stull

2 Ella Issaels
Assistant Secretary for Administration
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Athrica 102 Clavia
Assistant Secretary for Enforcement, Tariff and Trade Affairs and Operations
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8/40/73
/ /
E mani m. lalit
Associate Director, Division of Federal Reserve Bank Operations, Board of Governors of the Federal Reserve System
Source of Governors of the rederal Reserve System
9/5/2-
11/11/
Following I
Director of the Mint

### Appendix B

#### A BILL

To authorize the Secretary of the Treasury to change the alloy and weight of the one-cent piece.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 3515 of the Revised Statutes, as amended (31 U.S.C. 317), is further amended by designating the existing section as subsection (a) and by adding a new subsection (b) to read as follows:

"(b) Whenever the Secretary of the
Treasury determines that the use of copper
in the one-cent piece is no longer
practicable, he may change the alloy of
the one-cent piece to not less than 96 per
centum of aluminum and such other metals
as he shall determine. The one-cent piece
authorized by this subsection shall have
such weight as may be prescribed by the
Secretary."

#### Appendix C

## EXPERIMENTAL PROCEDURES FOR COINING STUDIES

Strips of each alloy were received in the hard "as rolled" condition and samples were taken to verify chemical composition, thickness, and Rockwell hardness. A 15 kg load hardness test was used. Several feet of each copper-zinc and aluminum alloy were cold rolled at the Philadelphia Mint to standard penny strip thickness of 0.0495 ± 0.0015 inches. The bronze clad steel and chromized steel sample strips were received at the proper thickness. The strips were then blanked using standard gilding metal blanking tool clearances of approximately 7 percent. Blank diameter and hardnesses were measured.

The blanks were softened by heating to various temperatures in a continuous belt annealing furnace in order to simulate production annealing conditions and hardnesses were again recorded. Approximately sixteen minutes were required to travel through the furnace hot zone. It is estimated that the temperature of the blanks reached the furnace temperature for a small fraction of this period.

In preparation for coining, the blanks were cleaned to remove tarnish, grease, or dirt. The bronze alloys and bronze clad steel were tumbled in a cleaning solution of soap bark and cream of tartar for 15 to 20 minutes and the aluminum alloys and chromized steel were rubbed clean with a cloth saturated with alcohol. Some of each type of blank were upset using the standard penny blank upsetting machines and others were tested in the nonupset condition. Aluminum was later tested using several edge upset configurations.

Blanks of each alloy and gage, upset and nonupset, were then coined using nonsense dies, and the tonnage

required for complete fill of image detail and lettering was recorded. In some cases, complete fill could not be achieved. The nonsense dies were designed to simulate the actual penny dies with regard to relief and location of images and lettering. In this way, coining characteristics of the alloys could be compared relative to one another without creating a large number of potentially valuable numismatic oddities, i.e., pennies stamped of alloys other than 95 percent copper - 5 percent zinc, gilding metal. Finally, 1974 cent dies were used to strike a carefully controlled number of aluminum alloy coins.

#### Appendix D

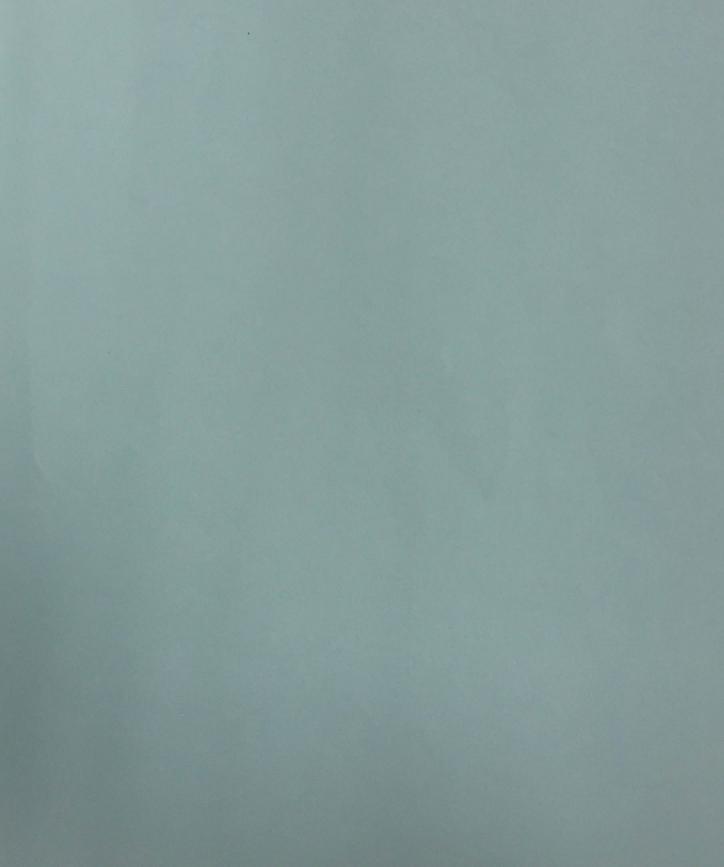
EXPERIMENTAL PROCEDURE FOR WEAR-CORROSION TESTS

The accelerated wear-corrosion tests involved exposure of the experimental alloys to conditions which approximate actual service for circulating coinage. From extensive weighing of circulating cents drawn from circulation, it is concluded that the test simulates 1 1/2 to 2 years of service.

Note that blanks were utilized in lieu of coins for reasons of security. Although the absolute weight losses would have been higher had coins been used, the comparison is valid for blanks since the relative losses in weight rather than absolute losses (which are a function of contour) are relevant for purposes of this study.

Five hard, upset, blanks representing each experimental alloy and five gilding metal blanks were weighed and subjected to 48 hours of tumbling in a ball mill containing 450 milliliters of SAE 30 oil, 150 milliliters of artificial sweat solution and 3 pounds of sea sand. The sweat solution consisted of: 10.00 grams NaCl; 1.25 grams Na<sub>2</sub> HPO<sub>4</sub>; 1 milliliter lactic acid; and 1 liter distilled water.

The blanks were weighed before and after tumbling in order to determine the weight loss. A comparison was made between the percentage weight losses for the experimental alloys and for the gilding metal blanks.





OPTIONAL FORM NO. 10
MAY 1002 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

# MemorandumRECEIVED

TO

F. H. MacDonald

DEC 21 1973

DATE: December 19, 1973

FROM

Alan J. Goldman

OFFICE OF SUPERINTENDENT

U. S. MINT AT DENVER

SUBJECT:

Report on Visits to the Italian, Spanish and Portuguese Mints

Visits to the Italian, Spanish and Portuguese Mints were made during the first two weeks in December in order to discuss technical problems encountered and processes used in the fabrication of aluminum strip and manufacture of aluminum coins, and to observe productions related to the manufacture of aluminum and all other coins for issue at each of the three facilities.

Based upon information gained during our visits, we foresee no problems of consequence in going into production on the aluminum cent coin. Annealing of blanks will not be required, and upsetting may not be necessary. Also, after further investigation with our strip suppliers, we may be able to eliminate the cleaning of aluminum blanks by purchasing strip in a sufficiently clean condition, as is the recent procedure at the Portuguese Mint.

A detailed report on our visit to each of the three mints is provided in the following paragraphs.

ITALIAN MINT (G. Pinzaronni, M. Girlanda)

A coin shortage was evident in Rome where merchants used pieces of hard candy and, in one case, a half stick of gum to make up correct change. It is difficult to comprehend the reasons for the Mint operating on only one shift per day when more extensive production could relieve the shortage of coins.



An aluminum alloy containing 3.5 ± 0.3% magnesium and 0.3 ± 0.1% manganese is used for the 10 lire (having a value 1.6 cents) and 5 lire (having a value of 0.8 cents) coins. Strip is produced in-house from both semi-continuously cast ingots and purchased extrusions. A resistance or medium frequency furnace is used to melt the alloy. Foseco 20213 (Terracote 35) is used for the melt cover to eliminate impurities. Four castings having dimensions 3" x 10" x 9-1/2 feet are produced simultaneously. An aluminum-magnesium mold is used in the casting machine. The casting speed is approximately 3" per minute.

The ingots are soaked in an electric resistance furnace at 1020°F for 24 hours and furnace cooled. The surface is then milled before reheating to 900°F for hot rolling. After six hours at this temperature, the ingot is hot rolled to a thickness of 0.100" and coiled. The coils are slit and then welded under an argon blanket. Extrusions having a cross section of 0.480" x 3.22" are cold rolled to 0.100", welded and then handled in the same manner as the material cast in-house.

After cold rolling to approximately 25% above the final thickness, the coils are annealed at 800°F for 8 hours and the surface wire brushed. The coils are then rolled to finish gage and blanked. Blanking scrap is coiled rather than chopped.

Aluminum blanks are barrel washed in a water soluble detergent, rinsed in water and dried in a centrifugal drier. The latter process also deburrs the edges of the blanks. After blank inspection, the

blanks are ready for coining. The 5 and 10 lire blanks are not upset before striking.

No lubrication is applied to the blanks prior to their placement in the feeding bowls of the presses; however, a light machine oil is applied to the edges of the blanks (of aluminum, bronze and stainless steel) by felt surrounding the tube feeder.

Die life for the aluminum coins is 200-300,000 compared with 120,000 for bronze and 80,000 for stainless steel. The hardness of the blanks prior to coining is  $R_{15T-81}$ 

Other points of interest are as follows:

- 1. An automated batch type container mounted on a track and having 2 additional degrees of freedom for rotation in and out of the solutions and for rotation while in the baths is used for holding blanks during cleaning and rinsing.
- 2. A steel containing 0.56% C, 0.75% Si, 0.30% Mn, 1.00% Cr, 2.25% W is used for dies. It is hardness in a salt bath at 1670°F, quenched in oil and tempered at 575°C to a hardness of Rockwell C 60-65. Holden "Hard Case 600°C" is the salt used in the hardening furnace.
- 3. 1.5-2.0 million coins are produced on one shift each day using 16 Schuler M150 presses operating at 250-275 SPM and 9 old Taylor-Challen presses. A maximum of 2.5 million pieces have been produced on a 12-hour shift.

- 4. Typical press tonnages for coining are 80 and 100 tons for the 50 and 100 lire stainless steel pieces and 40-50 tons for the 10 lire aluminum piece. The diameter of the latter (23.3 MM) is only slightly less than that of the 50-lire piece (24.8 MM).
- 5. Medals are made from an alloy containing 80% copper-20% zinc. They have a more brassy appearance than the U.S. Mint's 90% copper-10% zinc bronze medals.

#### VISIT TO MADRID, SPAIN MINT

Met with Mr. Jose E. Morando, Chief of Coin Production, and his two assistants.

Although in the past several years Spain has produced two high aluminum alloy coins, the 10-Centimo piece was dropped from production during CY 1972 and the 50-Centimo piece while being struck this year, will not be struck thereafter. The apparent reason for deleting the two aluminum coins from production is their low face value and the lack of need for fractional-Peseta coins in daily commercial transactions, since prices for the most part are quoted in even Pesetas.

The 50-Centimos coins is comprised of 96.5% aluminum and 3.5% magnesium, the material for which is all purchased in approximately 5-inch strip width, from Alcan-Spain. Strip is stored indoors always and long-term storage presents no problem on surface quality.

The procedure for processing the purchased aluminum strip into 50-Centimos coins is as follows. Coils are set up in a Cradle-straightener for feeding into the blanking press (six presses, one

of which is relatively new, were noted). Wynns metal working concentrate soluble oil, with a mixture of 1 part oil to 99 parts water, is applied to the strip by means of a drip lubrication system immediately preceding the die set. This is to reduce dispersion of aluminum dust and wear on the punches and thimbles for longer life between sharpenings. Web scrap from the blanking press is recoiled in strip form and returned to the strip supplier. The newer blanking press can be operated at about 300 spm on the 5-inch aluminum strip.

Aluminum blanks are not annealed, but are moved directly to the cleaning line after blanking. This is important in order to remove the soluble oil residue from the blanks to deter stain and discoloration. Blanks are cleaned by tumbling in an alkaline detergent (Alcasol) mixture of 1 part detergent to 20 parts water, for about 1 hour. Blanks are then rinsed tumbled for about 1 minute in 2% sulfuric acid solution to brighten the surface, rinsed in water, and then tumbled in a heated air stream, 320 pounds per 1/2 hour. The 50-Centimo blanks are not upset.

The aluminum blanks are then moved to the coin press operation for coining. One MI50 Schuler press was observed stamping the 50-Centimo coin at a rate of 150 spm. No lubricant is applied to the face of the blank; however, the edges of blanks for all reeded coins, including the 50-Centimo, are lubricated on the edges by the application of vaseline by hand.

Hardness of the aluminum blanks is about R<sub>15T-81</sub>. Die life experienced on the 50-Centimos coin is relatively low: Obverse, 270,000 and reverse, 776,000 strikes per die -- design of the dies contribute to a high rate of cracking of the obverse dies. The die life, however, is still in excess of that experienced on the 1-Pesata coin which is about equivalent in diameter but a harder copper/aluminum alloy: Obverse, 186,000 and reverse, 298,000 strikes.

Other points of interest relative to the Spanish Mint operations follow.

- 1. The Spanish Mint is part of a complex which includes the Mint, the printing of currency and stamps, and the government printing function. Overall administrative support for purchasing, personnel, payroll, security and maintenance is provided by the central complex, with the Mint being responsible for its own operations. The Mint is a modern facility, well kept, and is being operated in an efficient manner, it appears.
- 2. Four AJAX Magnathermic induction furnaces, 400 pound capacity, 150 KW, 2100 cycles per second are in use and cast each 400 pound melt into two book molds. Cupro-nickel and aluminum-bronze are cast into 335 MM x 72 MM x 1 meter long ingots, 2 from each furnace.
- 3. Cupro-nickel ingots are heated to 980°C in a resistance furnace and hot-rolled from 72 MM gauge to 12.5 MM gauge.

  Slabs are then milled on a Loewy-Robertson miller with 1/2 MM being removed from each side, then cold rolled to 4 MM, upcoiled, and annealed. (Not rolling and cold rolling are

executed on the same mill, with rolls being changed out for each change from hot to cold rolling.) Annealing is performed to eliminate springing of the coils on the payoff reel into the pickeling and welding process and into the finish mill.

- 4. Cupro-nickel coils are then processed through a sulfuric-dichromate cleaning solution and 4 coils are welded together on an in-line operation. The welded coils are then processed through a two-high, reversing, finish mill to a final gauge of 1.56 MM (5 Peseta), blanked, upset and blanks are then annealed on two 24-inch wide belt, annealing furnaces.
- 5. The Spanish Mint currently has 3 Schuler and 28 Spanish type coin presses, and has expressed some problems with the Schuler press and an interest in the HME press. One press operator is assigned 2 presses. Average production is 1.6 million pieces per day on one 11-hour shift per day with total Mint employment at 160.
  - 6. All blanks, other than aluminum, are counted between processes for security. Aluminum blanks are weighed, only.
  - 7. The Spanish Mint has an S and K (Schurman), 1250 ton, hydraulic press on hand like the one we have on order. Their use for the press during the year it has been installed is for medal striking. Although their press has the hydraulic extraction device for use in work with collars, they prefer to not use collars for the 3-inch diameter medals because more strikes are required and the medals fin badly. The medals are thus allowed to splash, which is removed by use of cutting tool and lathe after the medal is finished. The

Spanish Mint is able to strike a very high relief medal in pure copper with 2 strikes on the press (interim anneal), without a collar, at 125-150 Kg. per square millimeter pressure. The pure copper medals are dipped in ammonium-sulfate solution for final surface treatment which imparts an attractive antique finish.

## Metallurgical Laboratory (Dr. Ordonez and Mr. Martinez)

The metallurgical laboratory is part of the laboratory which services the Engraving and Printing factories as well as the Mint. The major pieces of equipment are a Perkin-Elmer 403 atomic absorption unit, a single channel Hilger-Watts X-ray spectrograph and several metallagraphic microscopes.

The aluminum coinage alloy is analyzed primarily using the atomic absorption unit to measure magnesium, manganese, iron, copper, bismuth, chromium, antimony, lead, nickel and zinc.

Aluminum content is calculated by difference. Two typical analyses are attached. Silicon content is sometimes measured by a wet chemical technique but it has never been present in amounts exceeding 0.1% in the material supplied by Alcan (Spain). The allowable magnesium content is 3.5-4.0%. Manganese is allowable up to 0.5% maximum, iron to 0.3% maximum, copper to 0.2% maximum, and other elements to 0.01% each except silicon as mentioned above. (The presence of magnesium, manganese, iron and copper in the amounts indicated on the typical analyses results in a coin and coin blank of greater hardness than necessary. The high blank hardness forces

the Spanish Mint to use lubricant during blanking. This, then forces them to clean the blanks even though the as-received strip is clean and free of metal fines and rolling oil. In spite of the hardness, they are able to coin without annealing; however, die life is, no doubt, adversely affected by the hardness of the blank.)

The proper tubes and liquid standards will be required at our laboratories so that the atomic absorption units at our facilities can be used to rapidly measure aluminum content by difference as is done at the Spanish Mint.

The Spanish Mint laboratory had rejected three in-house cupronickel melts for insufficient nickel content on the day we visited the laboratory. Castings do not meet the chemistry specifications are remelted. It is noted that their specification of allowable copper content of 74.5-75.5% and manganese content of 0-0.4% is tighter than that used by the U.S. Mint. Sodium, lithium and magnesium have been tried as deoxidents for 75-25 cupro-nickel and discarded. Silicon is added occasionally as a Cu-Si master alloy. The maximum allowable residual silicon is 0.1%.

The laboratory is involved in counterfeiting studies in much the same manner as the Washington laboratory of the U.S. Mint.

The Spanish Government has a much more severe problem with counterfeit current coins than we have. Most are manufactured in North Africa. We were shown stainless steel, tin-lead-antimony and nickel plated brass versions of the 75-25 cupro-nickel 50 peseta counterfeit current coins with a similar surface appearance to 75-25 cupro-nickel. We were also shown a laminated gold plated platinum-copper-silver coin which weighs the same as the valuable 1880

gold piece that was falsified. The quality of engraving on the counterfeit coins was generally fair to poor.

Museum

The Spanish Mint-Engraving and Printing building houses a beautifully displayed, very extensive collection of ancient and more recent coins, medals, paper money, some antique furniture and old blanking and coining equipment. The museum is open to the public without charge. Medals are sold at the museum.

THE MINT OF PORTUGAL (Fernando M. P. Moutinho)

In 1969, the alloy of the 10 centavo coin was changed from copper-3 zinc-2 tin to aluminum-2.5% magnesium. The value of this coin is 0.4 cents and very few are seen in circulation. The very light weight (0.5 gm.) and diameter (15 MM which is noticeably smaller than the 19.05 MM U.S. cent) caused initial lack of public acceptance and inflation has caused the piece to have very little purchasing value. Portugal is starting to consider the metal value of all of their copper-containing coins and Mr. Moutinho was interested in a copy of the Treasury Department report on alternate coinage materials.

Aluminum alloy strip is purchased in the clean, oil-free condition from Alcan and can be stored in an air-conditioned vault prior to blanking. Coin blank scrap is chopped and remelted for purposes other than coinage. Although aluminum blanks have been traditionally barrel-cleaned in a detergent solution, the Mint . has recently eliminated the cleaning step without adversely affecting coinability or die life. Blanks are upset prior to coining. The blanks are coined without any application of lubrication to

their edges or faces. Press speeds for aluminum and somewhat lower them for bronze blanks (150 vs. 200 spm) but this is due to the small size of the coin as well as the light weight. The 10 centavos have not yet been tried on HME coinmaster 1 presses which were striking 50 centavo bronze coins at 275 spm during our visit. Blank hardness runs about  $R_{15T-67}$  and die life for aluminum coins is higher than for bronze of similar size.

The coin requirements of Portugal have increased greatly from 58 million in 1971 to 310 million in 1974. Modernization is in process in order to meet the rapidly expanding demand for coins. Mr. Moutinho was very interested in the 4-strike coining presses used by the U.S. Mint and is planning to visit the Philadelphia Mint next spring. HME and Bliss will be informed that the Mint of Portugal is another prospective customer for multi-strike coining presses.

Other points of interest noted in our visit to the Portugal Mint are discussed.

- 1. The Portugal Mint apparently casts all cupro-nickel material for the 5 and 2-1/2 Escudo coins in-house, and we cobserved the melting and manual casting of cupro-nickel into a series of approximately 3" x 12" book molds.
  - 2. An extensive effort was noted on processing cupro-nickel. Three of 4 roll mills on hand were engaged in running down the 3" x 12" x 1/2" ingots to finished gauge. One blanking press was observed and it was blanking cupro-nickel material.

- 3. In the coin press area, 11 coin presses were noted -- 3

  HME Coinmaster No. 1, 2 Grabener, 1 older Schuler, and 5

  others. Two operators are assigned to each three coin

  presses, who usually take care of die setting also. The

  Mint is operated 2 shifts per day, 5 days per week, for an

  expected CY 1973 production of 250 million coins. With this

  production rate, Portugal is still experiencing a significant

  coin shortage.
- 4. In observing the inspection operation, it appears all coins above the 1 Escudo denomination are inspected, whereas all others are inspected by sampling techniques. The 2-1/2, 5 and 10 Escudo coins are dropped invididually on a granite surface to detect ring which appears to vary with the density of the coin, thickness, delamination, etc. No mechanical devices are used in the inspection procedure; however, Mr. Moutinho indicated they were purchasing some endless belt-type equipment over which coins will be passed (similar to the inspection tables we have) for reviewing.

Contact with each Mint was made through the respective U.S. Embassy in Rome, Madrid, and Lisbon. Embassy personnel contacted were helpful and we found the Mint personnel at each of the facilities to be courteous and cooperative in all respects.

cc: N. G. Theodore

N. Costanzo

B. Higby

B. T. Brockenborough

R. C. Cahoon

A. Bresnick

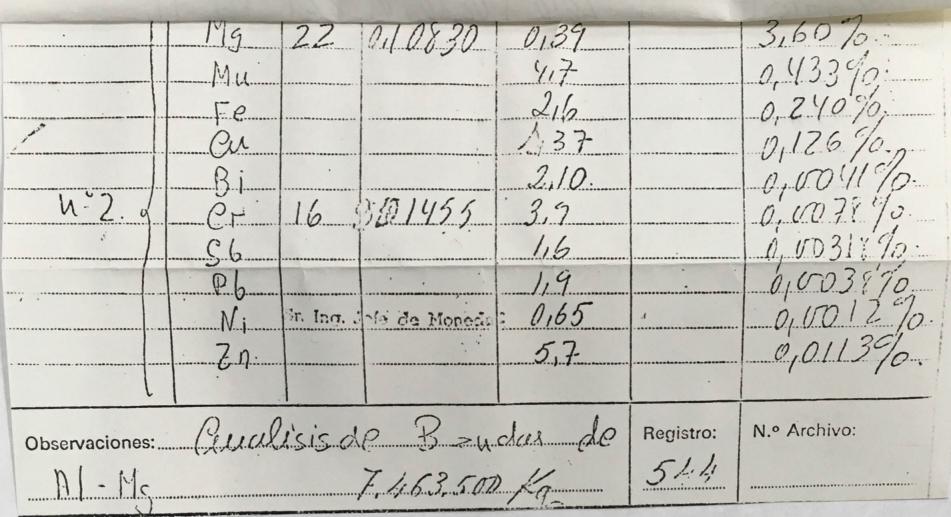
A. J. Goldman

G. G. Ambrose

# INFORMATION ON ALUMINUM COINS December 17, 1973

	ITALY	SPAIN	PORTUGAL
ALUMINUM COIN MFG.	10 Lire 5 Lire	50 Centimo	10 Centavo
ALLOY	3.5% Magnesium 0.3% Magnesium	3.5% Magnesium	2.5% Magnesium
IN-HOUSE AL ALLOY, PROD.	Yes	No	No
PURCHASED AL ALLOY STRIP	No	Yes	(Oil-Free) Yes
STRIP LUBRICATED BEFORE BLANKING	No	Yes	No
WEB SCRAP COILED	Yes	Yes	No-Chopped
BLANKS ANNEALED	No	No	No
BLANKS			
WASHED IN DETERGENT, AND RINSED	Yes	Yes + 2% Sulfuric Acid	No
DRIED	Centrifugal	Warm Air	No
UPSET	No	No	Yes
LUBRICATED (EDGES)	Yes	Yes	No
HARDNESS (R15T)	81	81	67
COINS			
EDGE	Smooth	Reeded	Smooth
DIE LIFE	200-300,000	Obv. 270,000 Rev. 776,000	

F. N. M. T.	SERVICIO DE MONEDA Y METALES					O. E. n.º
LABORATORIO	HOJA DE ENSAYO					
Analistas: Janlo Camadio - Chilerino Fi					Firma:	A
Turno:	215.	Fecha: 10/11 7-3				34
N . DE ENSAYO	CLASE	VASO	PESADA	CONSUMO	FACTOR	6 RESULTADO
11:-1	My Mu Fe en B1 Cr S6 P6 Vi Zn	12	250415	0,39. 4,8 216. 1102 2,06 3,4 1,0 1,8 0,70. 5,9		3,82%. 0,110%. 0,255%. 0,100%. 0,004111%. 0,00678%. 0,00199%. 0,0035%. 0,00139%. 0,0118%.
W-2.	Mg Mu Fe Cu Bi Cr Sb Pb Ni Zn	16	0.1.08.30 3.0.145.5	0,39 4,7 2,16 1,37 2,10 3,9 1,6 1,9 0,65 5,7		3,60%.  0,43390.  0,43390.  0,240%.  0,126%.  0,10041%.  0,003870.  0,0012%.  0,013%.





# RECEIVED WASHINGTON 20220

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DEC 1 0 1973

DEC 7 1973

1 & Study

OFFICE OF SUPERINTENDENT U. S. MINT AT DENVER

Dear Mr. President:

There is transmitted herewith a draft bill
"To authorize the Secretary of the Treasury to
change the alloy and weight of the one-cent piece."

Section 3515 of the Revised Statutes, as amended (31 U.S.C. 317), now requires that the alloy of the one-cent piece be 95% copper and 5% zinc and that it weigh 48 grains. The draft bill would authorize the Secretary, when he determines that the use of copper in the one-cent piece is no longer practicable, to change the alloy to not less than 96% aluminum and such other metals as he shall determine, and to prescribe the weight of the one-cent piece composed of such alloy.

The proposed legislation is necessitated by the steadily rising price of copper, which has increased from approximately fifty cents per pound in January 1973 to almost one dollar by October of this year. The value of copper content of the one-cent piece has correspondingly increased to 0.6¢ per piece, to which manufacturing and transportation costs add another 0.2¢ per piece. If the price of copper rises to \$1.20 per pound, the cost of the metal, together with the production costs, will exceed the face value of the one-cent coin. If the price of copper rises to \$1.50 per pound, the metal value of the coin alone will exceed one cent and thus hoarding of pennies will become profitable.

The proposed legislation would permit the Secretary of the Treasury to change the alloy of the one-cent piece when the price or availability of copper no longer makes its use practicable in pennies, thereby preventing hoarding and the resultant shortage in pennies.

There is enclosed a comparative type which shows the changes the draft bill would make in existing law.

It would be appreciated if you would lay the draft bill before the Senate. An identical bill has been transmitted to the Speaker of the House of Representatives.

The Department has been advised by the Office of Management and Budget that there is no objection from the standpoint of the Administration's program to the submission of this proposed legislation to the Congress.

Sincerely yours,

George P. Shultz

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The Honorable
Gerald R. Ford
President of the Senate
Washington, D. C. 20510

Enclosures -2

# COMPARATIVE PRINT SHOWING CHANGES IN EXISTING LAW MADE BY DRAFT BILL

Changes in existing law proposed to be made by the draft bill are shown as follows (existing law proposed to be omitted is enclosed in brackets; new matter is underscored):

Section 3515 of the Revised Statutes, as amended
(31 U.S.C. 317)

Sec. 3515. (a) The minor coins of the United States shall be a five-cent piece, a three-cent piece, and a one-cent piece. The alloy for the five and three cent pieces shall be of copper and nickel, to be composed of three-fourths copper and one-fourth nickel. The alloy of the 1-cent piece shall be 95 per centum of copper and 5 per centum of zinc. The weight of the piece of five cents shall be seventy-seven and sixteen-hundredths grains troy; of the three-cent piece, thirty grains; and of the one-cent piece, forty-eight grains.

(b) Whenever the Secretary of the Treasury determines that the use of copper in the one-cent piece is no longer practicable, he may change the alloy of the one-cent piece to not less than 96 per centum of aluminum and such other metals as he shall determine.

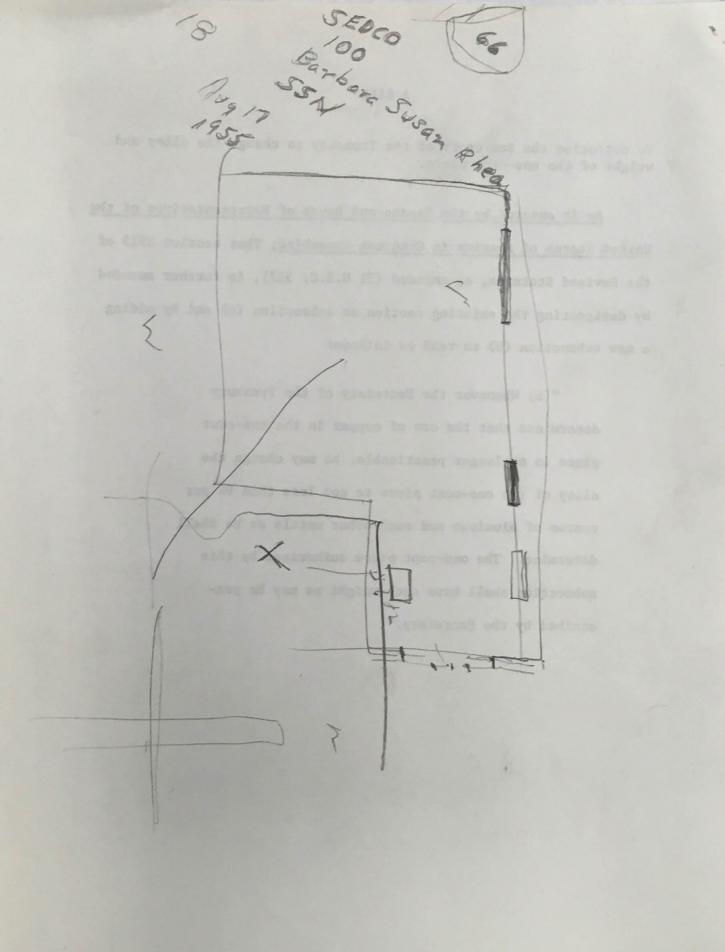
The one-cent piece authorized by this subsection shall have such weight as may be prescribed by the Secretary.

#### A BILL

To authorize the Secretary of the Treasury to change the alloy and weight of the one-cent piece.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section 3515 of the Revised Statutes, as amended (31 U.S.C. 317), is further amended by designating the existing section as subsection (a) and by adding a new subsection (b) to read as follows:

"(b) Whenever the Secretary of the Treasury determines that the use of copper in the one-cent piece is no longer practicable, he may change the alloy of the one-cent piece to not less than 96 per centum of aluminum and such other metals as he shall determine. The one-cent piece authorized by this subsection shall have such weight as may be prescribed by the Secretary."



OFFICIAL USE ONLY

FUTURE CENT DEMAND AND MATERIALS STUDY COMMITTEE MEETING - NOVEMBER 7, 1973

The Study Committee convened at the second floor conference room at 1331 G Street N.W., Washington, D.C. Present at this meeting were Mr. R. Schmidt, Mr. H. Hervey, Dr. C. Friedman and Ms. D. Kramer, Office of the Secretary of the Treasury; Mr. J. Stull and Mr. E. Chaney, Federal Reserve Board; and Dr. A. Goldman, Dr. G. Hunter, Ms. D. Duke, Mr. F. DeLeo and Mr. W. Murphy, Bureau of the Mint.

The meeting opened with Dr. Goldman updating the committee members on the events of the past month. These included the drafting of legislation for a new one-cent material and the subsequent approval of the draft by top Treasury officials. This legislation would give the Secretary of the Treasury the authority to change the material used in the production of the one-cent piece from 95% copper-5% zinc to an aluminum alloy of at least 96% aluminum.

At present an aluminum-magnesium alloy is the one which is being considered because it would lend itself more readily to in-house strip production. An aluminum-1.2% manganese alloy is also suitable for striking one-cent coins.

The events of the past month have made it necessary to present the written committee report in two parts. The first part will be a report dealing with the alternate materials and will be finalized within the next month. The second part, dealing with forecasting procedures and estimates, will be completed in April of 1974.

Each sub-committee presented a status report of their findings and/or conclusions to date:

<u>Sub-Committee One</u> - reported that the supply-demand report concerning aluminum, chromium, copper, magnesium, manganese, iron and zinc will be completed within the next two weeks. Mr. Hervey and Mr. Smith are working with this sub-committee to expedite this report.

The Mint's fractional usage of brass mill capacity and aluminum mill capacity for FY 74 one-cent material would be 2.28% for brass and 0.42% for aluminum. Our

impact on the brass mill industry would be 5.42 times as great as on the aluminum mill industry due to the fact that less aluminum strip would be required to produce the one-cent piece and aluminum sheet and plate shipments in 1972 were 60% greater than the shipments of brass mill products.

While attending the convention of the National Automatic Merchandising Association recently held in Chicago, Dr. Hunter was able to discuss the impact of a change in the make-up of a one-cent piece with both coin handling industry and vending machine manufacturing officials.

The coin handling industry foresees no immediate problems should a change take place. Dr. Hunter was able to verify this by testing blanks at Whitaker Bros. Business Machines Co. in Washington.

Vending machine officials from National Rejectors Co. stated that their plans were to utilize electro-optical detection in future machines in order to obtain greater reliability. These more expensive devices will be needed to detect aluminum coins. Mars Money Systems Co., however, has an expensive machine with a completely different principle. It could easily be modified for aluminum cents. The Coin Acceptors Co. has just introduced the only vending machine changemaker which accepts and makes change in cents. This machine will be made obsolete by aluminum cents. However, vending industry adoption of odd cent pricing is controversial. Dr. Hunter will provide the committee with annual reports of Coin Acceptors Co. and National Rejectors Co. by the next committee meeting.

Experiments to determine wear and corrosion effects on the three aluminum alloys, chromized steel, and 70-30 cartridge brass are in progress and a complete analysis will be available in two weeks.

After a discussion concerning the current withdrawal of the San Francisco one-cent piece from circulation by the general public it was decided that Sub-Committee Three would look into the advantages and disadvantages of eliminating the mint mark on pennies.

Sub-Committee Two - reported that the Sears Survey is underway and results would be available in two weeks. Since information concerning the coin inventories of these stores will be included in this survey, it was decided that after the compilation of data was completed the sub-committee would question Sears officials concerning their reported negative flow-back to the banks during the January to March period.

This sub-committee will provide Sub-Committee Three with a list of the variables used to select the stores in the survey.

The market study concerning the acceptability of introducing a two or a two and one half cent piece will be discussed at a future meeting. The committee was reminded that preliminary steps in acquiring a consulting firm would take four months.

This sub-committee will begin to look into the ramifications resulting from a change in the make-up of the one-cent piece and determine the best means of informing the public so as to minimize the possibility of a coin shortage.

Sub-Committee Three - distributed a preliminary report on the coinage production and distribution systems. Mr. Schmidt invited members of the committee to offer some ideas along with factual criticism on the report and attend their next sub-committee meeting to be held on Monday, November 19, 1973 at 10:00 A.M. in Room 902 of the Global Building located at 1025 Vermont Avenue, N.W., Washington, D.C.

Mr. Schmidt will contact the Mint's Budget and Finance Division to acquire the actual dollar total of recent U.S. coinage overtime costs. Also to be determined is whether or not overtime needed to produce domestic coins at one location because of the production of foreign coins at another location is charged to the cost of producing the foreign coins.

Dr. Friedman gave a preliminary report of the regression analysis and provided the committee with a

graph and table showing those variables which correlate with net payout. To be incorporated in his final report will be the data provided by the Sears Survey being conducted by Sub-Committee Two.

Mr. Chaney discussed the Federal Reserve Bank short-term monthly net payout requirements which is a forecasting method based on several models. Sub-Committee Three will review the results obtained from Mr. Chaney's forecasting models.

Mr. Stull reported that there has been no official response from the Canadian Banking Association and that after contacting the Assistant Director of that organization by phone it was determined that there is no data available on the use of the U.S. one-cent piece in Canada. He will attempt to acquire information concerning the amount of coins returned to the U.S. by the Canadian Banks.

Mr. Stull's material concerning coin inventories at banks has been converted to reflect inventory per bank and bank branch by denomination. A summary is attached.

The next meeting of the Study Committee will be held on Wednesday, December 5, 1973 at 9:30 A.M. on the second floor conference room at 1331 G Street N.W., Washington, D.C.

Attachment

W.J. Murphy/A.J. Goldman November 13, 1973

## Average Coin Inventories of Commercial Banks and Branches (In thousands of pieces)

	CENTS	NICKELS	DIMES	QUARTERS	HALVES	DOLLARS
Large Commercial Bank						
Range	230-12,500	156-5,600	220 14 000	276 1/ 200	FO 1 000	0.05
Mean	2,630	1,817	320-14,000	276-14,800	50-1,060	8-35
Median	1,515	1,120	3,631	2,998	183	20
	1,515	1,120	2,201	1,467	102	33
Medium Sized Commercial						
Bank						
Range	50-10,900	35-2,400	50-6,320	36-2,924	3-188	0 5 00
Mean	1,258	423	1,035	579		0.5-22
Median	215	56	118	103	28 11	21.
		30	110	103	**	3.4
Small Commercial Bank						
Range	5-200	4-132	5-275	4-200	1-12	0.2-2
Mean	78	38	67	51	5	0.2-2
Median	44	19	30	. 23	4	1.0
						1.0
Mean for all Commercial	1,322	507	1.570			
Banks	1,322	527	1,578	1,209	72	, 9.3
Large Commercial Bank Bra	nch					
Range	5-200	6-60	15-100	8-824	1-10	05.2
Mean	66	28	48	118		.05-3
Median	40	20	30	32	3 2	0.6
	40	20	30	32	2	.06
Medium Sized Commercial						•
Bank Branch						
Range	5-300	6-120	8-200	8-100	.4-20	.1-1.9
Mean	96	34	77	45	.4-20	0.5
Median	. 28	17	31	33	2.5	0.1
				33	2.5	0.1
Small Commercial Bank Bran	nch					
Range	5-60	1.2-24	3-42	2-32	0.6-3	.3-1
Mean	26	10	19	14	1.3	0.1
Median	23	8	. 15	11	1.0	0.1
Mean for all Commercial Ba	ank					
Branches	63	24	48	59	3.1	. 0.4
DI direite o						

Future Cent Demand and Materials Study Committee Meeting - October 10, 1973

The Study Committee convened at the second floor conference room at 1331 G Street N.W., Washington, D.C. Present at this meeting were Mr. R. Schmidt, Mr. C. Smith, Mr. H. Hervey and Dr. C. Friedman, Office of the Secretary of the Treasury; Mr. J. Stull, Federal Reserve Board; and Dr. A. Goldman, Dr. G. Hunter, Ms. D. Duke, Mr. F. DeLeo and Mr. W. Murphy, Bureau of the Mint.

The meeting opened with each sub-committee presenting a status report of their findings and/or conclusions to date:

Sub-Committee One reported on the progress of the alloy study being conducted at the Philadelphia Mint. Three aluminum alloys are being studied in terms of relative force needed to produce acceptable coins. Minor die design changes to accommodate soft alloys as well as changes in materials are being investigated. Additional technical information on the various alloys will be available at the next committee meeting.

Also presented were the findings on the possibility of lower density pennies being counted in sorting machines as a higher denomination. The assistant chief engineer of Brandt Money Handling Products, Inc., a major coin handling equipment manufacturer, felt that (1) a change in diameter would be critical, (2) a change in thickness would require changes in their machines and (3) the effect of a change in density requires experimentation which will be done by Brandt.

The data provided by the Bureau of Mines on the supply and demand picture through the year 2000 has been studied and will be available at the next committee meeting. Magnesium and manganese have been added to the list of the metals being reviewed (aluminum, chromium, copper, iron, nickel and zinc) because of their use as common alloying elements to aluminum.

Sub-Committee One will contact the Copper Development Association and the Aluminum Association and attempt to acquire the total strip capacity of the two industries to ascertain the fraction of the strip manufactured which is used by the Mint.

Sub-Committee Two reported that after a successful meeting with Sears Officials in Philadelphia, an agreement was reached whereby a random sample of coins would be surveyed in 200 Sears stores, selected by size and geographical distribution. The survey will take place on November 5, 1973. The sample of 300 pieces for each denomination at each store will provide the sub-committee with information on the annual loss rate and the number of pieces in circulation. The questionnaire will also ask for their coin inventory and weekly requirements of coin. When the compilation of information is summarized, Sub-Committee Two will forward this data to Sub-Committee Three for analysis. Sears should be recontacted to determine whether or not their stores return coins to banks in January - March, the usual time of flowback to the FRB.

The acceptability study of aluminum coins is in process. Contact will be made with those Mints in foreign countries who have changed to an aluminum coin. It was pointed out that while they were never mass produced in the United States for circulation, experimental aluminum coins were made in the 1860's in United States Mints.

A market survey by a professional firm is being considered. Contact will be made with the Mint's Procurement Division to expedite this.

Sub-Committee Three reported that a multiple regression analysis of the various data submitted would be available at the next committee meeting. Gross National Product forecasts through 1980, submitted by Mr. Hervey, and estimates of NCR cash register production will be included in this analysis.

The sub-committee will compare actual penny production to the new short-term forecasting model on the penny, that was prepared by the Federal Reserve Board.

The sub-committee's short-term forecasting and inventory control study is also in progress. Flow charts of forecasting and planning procedures of the FRB have been prepared. The sub-committee will now study the Mint's Internal Product Planning Process.

The Canadian Banking Association has not provided any information on usage of the U.S. cent in Canada. Contact will be made again to acquire this information.

An analysis of the effect of adding a new denomination with or without the penny, done by the Office of Planning and Evaluation Division, was submitted to the committee. Conclusions: Substitution of a 2¢ or 2.5¢ piece will not decrease demand for coins. Addition of a 2¢ piece should decrease demand for coins. Pursuit of this alternative, however, will be postponed until January.

Mr. Stull is compiling information on the inventories necessary to stock commercial banks. This information will be finalized by the next committee meeting.

Sub-Committee Four reported that they will be available to the other sub-committees for assistance. Arrangements are being made for this sub-committee to visit a new Alcoa aluminum strip facility in November.

For the benefit of the entire committee and especially Sub-Committee Three, Mr. Sparks of the Mint's Accounting Division gave a summary of the meaning and effects of seigniorage and various funds, other than those appropriated by Congress, which are used to finance coinage activities.

The money used to purchase materials for the manufacture of coins, including fabrication of strip by private contractors, comes from the Coinage Metal Fund. The Coinage Profit Fund is used to defray transportation costs incurred when the Mint delivers coins to the FRB Banks.

Seigniorage is defined as the value of the difference between the face value of the coin and the cost of the materials purchased from private industry to produce coins. The latter includes the cost of raw materials and strip fabrication if finished strip is procured rather than manufactured in-house. A part of seigniorage goes into the Coinage Profit Fund and the balance goes into the General Fund of the Treasury.

Mr. Sparks will provide the committee with a table on the seigniorage of pennies showing year by year, since 1960, the number of cents produced and the total seigniorage realized. This data will be compared to the seigniorage that would have been realized if an aluminum cent had been in use.

The next meeting of the Study Committee will be held on Wednesday, November 7, 1973 at 9:30 AM in the second floor conference room at 1331 G Street N.W., Washington, D.C.

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M) murphy h & fldwan W. J. Murphy/A. J. Goldman

October 16, 1973

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Future Cent Demand and Materials Study Committee Meeting - August 23, 1973

The Study Committee convened at the second floor conference room at 1331 G Street, N. W., Washington, D.C. Present at this meeting were Mr. A. Bresnick, Mr. G. Burhop, Mr. R. Schmidt, Office of the Secretary of the Treasury, Mr. J. Stull, Federal Reserve Board and Dr. G. Hunter, Mr. F. DeLeo, and Mr. W. Murphy, Bureau of the Mint.

The purposes of this meeting were to review the initial data and establish a possible correlation to the increase in coin demand.

The following data was provided by the committee members:

#### (1) Mr. J. Stull provided:

- A) The name of the Federal Reserve Board Official who will endorse the project outline will be Mr. McWhirter Associate Director, Federal Reserve Bank Operations.
- B) Tables representing the total number of commercial banks, the number of Savings and Loan Associations and branches and the number of commercial banking offices by banks and branches in the United States for each year from 1950 and 1973. Linear and semilogarithmical graphs compared to historic net payout of the Federal Reserve Banks were included (see Appendix A, Tables 1, 2 and 3).
- C) Tables showing the average and maximum inventories at Federal Reserve Banks and Branches by denomination. (See Appendix A, Tables 4 and 5). Mr. Stull is in the process of gathering data concerning the necessary inventories to stock a new commercial bank branch.
- D) Mr. Stull has encountered some difficulty in gathering information concerning the U. S. cent in Canada due to the fact that their Banking system does not accept deposits. However, he is awaiting an answer to a letter directed to the president of the Canadian Banking Association.

#### 2. Mr. R. Schmidt provided:

A) Information concerning total retail sales in dollar volume. (See Appendix A, Table 6) The total number of transactions is unobtainable.

B) Estimates concerning the total number of cash registers and drawers sold by all register manufacturers will be forthcoming.

#### 3. Mr. G. Burhop:

- A) While actual GNP data was easily obtainable (see Appendix A, Table 7), forecast data was not. They have been shown to be inaccurate and past records are incomplete. It was suggested either studying GNP trends or models created at University Economic Schools would aid the Study Committee. Mr. Burnop will pursue this.
- B) Due to anti-trust legislation there is no central clearing house which can provide information on the total number of credit card transactions and dollar volume. In contacting Mobil Oil Company, Mr. Burhop was informed that that company had 1 billion dollars in credit card transactions (i.e. total credit card dollar volume and not just Mobil credit cards), which is approximately 50% of their total dollar volume. This figure has been increasing at an 8 to 10 percent rate, which is close to their annual gross growth rate in sales volume. Mr. Burhop was referred to a University of Michigan study, Credit Card Use in the United States, which showed that while credit card use is growing, people are using it more as a short term loan rather than a way of simplifying or facilitating transactions. Total number of bank credit cards are up over 1971 by 40 percent and the average number of transactions per card has increased.
- C) Total sales tax revenues have increased from \$3 billion in 1946 to \$26.5 billion in 1969. (See Appendix A, Table 8)

#### 4. Dr. G. Hunter:

- A) All data concerning total coins used in vending machines are estimates based on total dollar transactions arrived at through surveys. While the survey data is available to the committee these estimates are based on the assumption that in a 45 cent transaction, for example, a quarter and two dimes were used.
- B) Information on parking meters and toll machines will be obtained by Mr. DeLeo from the Department of Transportation.

- C) While the Copper Development Association and the Aluminum Association do not provide forecasts, the Bureau of Mines, Department of the Interior and the Copper Division of the Commerce Department can supply forecasts of refined copper and aluminum. There does not appear to be a shortage of copper at least until the year 2000.
- D) The aluminum coins produced by the Mint for the Phillipine government have been circulating well based on the increase in production of these coins; up from 12 million in 1969 to 130 million in 1970.

Dr. Goldman has sent out a letter to Sears and Roebuck, exploring the possibility of sampling coins located in cash registers of a certain number of outlets. This sampling is to determine age distribution, the number of coins in circulation, and loss rates.

#### 5. Mr. Murphy:

A) Provided a table of population figures from 1950 to 1973 and a linear graph comparing population growth to Federal Reserve Bank net payout (See Appendix A, Table 9).

The Bureau of the Mint's Legal Counsel has looked into the feasibility of test marketing a two cent token and has determined that this would be against current legislation. Therefore, the Mint's Marketing Specialist will have to base the acceptability study of the two cent piece on the two dollar bill, other studies conducted by foreign governments, and questionnaires.

All members of the committee submitted their coin date lists and a discussion concerning the exchange of these unrolled coins showed that there is a resistance from the banks concerning the acceptance of unrolled coins based on volume, whether or not an account is held at these banks and how busy the teller was at the time of the request. It was felt that the Director of the Mint might be able to persuade the Banking Association to accept loose coins in a manner more convenient to the public.

It was decided that by the next meeting, the following would be provided:

- 1. Dr. Hunter and Mr. Schmidt will look into the kind of data treatment necessary to show correlation between coin demand and other economic indices.
- 2. Dr. Hunter will provide information concerning the possibility of lower density pennies being counted in sorting machines as a higher denomination piece.

- 3. Dr. Hunter will attempt to contact Dr. Morrison concerning his sources for arriving at coin intensive industry revenues.
- 4. Dr. Hunter will draft a letter requesting information concerning coin inventories in retail outlets.
- 5. Dr. Humter and Mr. DeLeo will determine the loss ratio and circulation pool of the coins provided in the sample taken by each member since the previous meeting (See Appendix A Table 10)
- 6. Mr. Stull will provide the minimum inventory figures of Federal Reserve Banks and Branches by denomination.
- 7. Mr. Bresnick, Mr. Schmidt and Dr. Hunter will provide a Management by Objectives statement and a more detailed project plan. A sub-committee meeting will be held on Wednesday, August 29, 1973, at Mr. Bresnick's office in the Global Building at 2:00 P.M. to discuss the objectives of the project.

The next Study Committee meeting will be held on Thursday, September 6, 1973, at 10:00 A.M. in the second floor conference room at 1331 G Street, N. W., Washington, D. C.

W. J. Murphy/G. E. Hunter August 29, 1973

TABLE 1

Number of Commercial Banks in the United States on June 30, 1950 through June 30, 1973\*

Fiscal Year	Number of Banks
1973	14,018
1972	13,838
1971	13,720
1970	13,664
1969	14,173
1968	14,223
1967	14,247
1966	14,307
1965	14,295
1964	14,175
1963	13,993
1962	13,934
1961	13,977
1960	14,000
1959	13,997
1958	14,055
1957	14,144
1956	14,206
1955	14,309
1954	14,465
1953	14,537
1952	14,599
1951	14,636
1950	14,674

9 19 0

\*Obtained from Federal Reserve Bulletin, July 1950-1973, table #A-18, Principal Assets and Liabilities and Number, by Class of Bank. (JLS/8-16-73)

TABLE 2

Number of Savings and Loan Associations and Branches by Calendar Year

Year End	Head Offices	Branches	<u>Total</u>
1972	5,448	5,793	11,241
1971	5,544	4,961	10,505
1970	5,669	4,318	9,987
1969	5,835	3,938	9,773
1968	5,947	3,667	9,614
1967	6,036	3,357	9,393
1966	6,112	3,206	9,318
1965	6,185	2,994	9,179
1964	6,222	2,769	8,991
1963	6,248	2,469	8,717
1962	6,289	2,179	8,468
1961	6,246	1,851	8,097
1960	6,320	1,611	7,931
1959	6,223	1,341	7,564
1958	6,207	1,120	7,327
1957	6,169	946	7,115
1956	6,136	754	6,890
1955	6,071	601	6,672
1950	5,992	(No data)	5,992*

<sup>\*</sup>Data for branches not available and therefore note included in total.

Number of Commercial Banking Offices by Bank and Branch on December 31, 1950 through December 31, 1972\*

Calendar Year	Number of Banks	Number of Branches	Total
1972	13,822	24,850	38,672
1971	13,702	23,296	36,998
1970	13,600	21,848	35,448
1969	13,578	20,396	33,974
1968	13,598	19,186	32,784
1967	13,641	18,080	31,721
1966	13,687	17,034	30,721
1965	13,713	15,882	29,595
1964	13,675	14,724	28,399
1963	13,487	13,617	27,104
1962	13,341	12,459	25,800
1961	13,345	11,465	24,810
1960	13,383	10,585	23,968
1959	13,385	9,757	23,142
1958	13,441	9,042	22,483
1957	13,500	8,268	21,768
1956	13,569	7,641	21,210
1955	13,647	6,975	20,622
1954	13,747	6,296	20,043
1953	13,886	5,816	19,702
1952	13,942	5,456	19,398
1951	13,987	5,145	19,132
1950	14,015	4,824	18,839

<sup>\*</sup>Obtained from Annual Report, Board of Governors of the Federal Reserve System, 1950-1972, table #19, Number of Par and Nonpar banking offices.

## Average Operating Inventories at Federal Reserve Banks and Branches (In thousands of pieces)

FR 186 (Rev. 7-71)

Control to the Control of the Contro											
	CENTS	NICKELS	DIMES	QUARTERS	HALVES	DOLLARS	TOTAL				
Dogton	50,000	22,000	44,000	36,800	1,800	200	154,800				
Boston	54,000	22,000	30,000	12,000	3,200	1,600	122,800				
Buffalo	17,500	4,000	15,000	8,000	2,000	1,000	47,500				
Philadelphia.	30,000	12,000	20,000	12,000	3,000	500	77,500				
Cleveland.	43,500	8,040	24,500	3,400	2,000	1,000	82,440				
Cincinnati	60,000	16,000	35,000	24,000	2,000	1,000	138,000				
Pittsburgh	15,000	12,000	25,000	14,000	1,600	800	68,400				
Richmond	16,000	4,600	12,000	4,800	1,600	800	39,800				
Baltimore	5,000	4,000	5,000	4,000	400	200	18,600				
Charlotte	8,000	3,400	8,000	4,000	1,000	500	24,900				
Culpeper											
Atlanta.	15,000	11,000	15,000	8,000	1,000	500	50,500				
Birmingham	9,000	3,200	8,000	4,000	1,000	700	25,900	i			
Jacksonville	12,000	6,000	20,000	8,000	1,000	500	47,500				
Miami	8,700	3,000	10,000	6,000	600	' 200	28,500				
Nashville	10,000	2,000	4,000	2,400	300	200	18,900				
New Orleans.	15,000	16,000	15,000	8,000	1,000	500	55,500				
Chicago.	75,000	20,000	50,000	32,000	6,000	4,000	187,000				
Detroit	10,000	4,500	10,000	8,000	800	800	34,100				
St. Louis	13,000	5,400	12,000	8,000	600	250	39,250				
Little Rock	10,000	2,000	3,500	3,000	500	150	19,150				
Louisville	25,000	20,000	12,000	12,000	500	250	69,750				
Memphis	22,500	10,000	25,000	10,000	800	300	68,600				
Minneapolis	40,000	10,000	27,500	16,000	1,000	750	95,250				
Helena	4,000	1,800	5,250	2,100	1,050	525	14,725				
Kansas City	16,000	14,000	30,000	14,000	4,000	1,000	79,000				
Denver	40,000	8,000	10,000	10,000	2,000	1,500	71,500			-	-
Oklahoma City	5,000	3,500	6,500	3,000	600	300	16,900			1 1	
Omaha	11,000	2,500	10,000	4,000	1,200	500	29,200				
Dallas	20,000	6,000	20,000	12,000	1,000	500	59,500				-
El Paso	5,400	2,920	4,000	2,000	200	200	14,720			-	
Houston	10,000	6,000	6,000	3,200	800	200	26,200				
San Antonio.	8,500	6,000	9,000	4,000	1,200	500	29,200			-	-
San Prancisco	25,000	8,000	10,000	14,000	3,200	1,500	61,500				
Los Angeles	15,000	8,000	15,000	6,000	2,000	2,000	48,000		-		
Portland	15,000	4,000	15,000	7,200	2,000	750	43,950				
Salt Lake City	10,000	3,000	5,500	3,000	700	700	22,900				
Senttle	22,500	5,000	15,000	6,000	1,000	500	50,000			-	
	771,600	297,860	591,750	338,900	54,450	27,375	2,081,935				
Total				Married Management of the Control of	The second residence of the last of the la				STATE OF THE PARTY		

## Maximum Storage Capacities of Federal Reserve Banks and Branches (In thousands of pieces)

FR 186 (Rev. 7-71)

CANCEL STREET,	1									
	CENTS	NICKELS	DIMES	QUARTERS	HALVES	DOLLARS		TOTAL	BAR	
Boston.	55,000	26,000	45,000	37,200	2,000	250		165,450		
New York.	80,000	40,000	60,000	24,000	1,600	800		206,400		
Buffalo	20,000	4,800	20,000	10,000	3,000	1,500		59,300		
Philadelphia.	50,000	20,000	30,000	16,000	4,000	500		120,500		
Cleveland	56,500	40,000	55,000	32,000	3,000	1,500		188,000		
Cincinnati	80,000	30,000	80,000	48,000	6,000	3,000		247,000		
Pittsburgh	20,000	16,000	40,000	20,000	2,000	1,000		99,000		
Richmond.	20,000	7,200	16,000	6,400	2,200	1,100		52,900		
Baltimore	10,000	8,000	10,000	10,000	1,000	500		39,500		
Charlotte		4,400	11,000	4,800	1,600	700		34,000		
Culpeper										
Atlanta	50,000	26,000	40,000	24,000	4,000	2,000	, '1	146,000		
Birmingham	17,400	4,000	12,000	, 6,000	2,000	1,500		42,900		
Jacksonville	16,000	9,360	30,000	12,000	1,500	750		69,610		
Miami	13,100	5,000	15,000	10,000	1,000	500		44,600		
Nashville	12,000	4,000	8,000	4,000	800	400		29,200		The second second
New Orleans		20,000	20,000	12,000	1,000	1,500		74,500		
Chicago	150,000	60,000	150,000	80,000	12,000	6,000		458,000		
Detroit	20,000	16,000	20,000	20,000	3,200	1,600		80,800		
St. Louis.	15,000	6,000	15,000	10,000	1,000	500		47,500		
Little Rock	15,000	3,000	5,000	4,000	800	250		28,050		
Louisville	30,000	24,000	20,000	20,000	2,000	1,000		97,000		
Memphis	26,600	13,440	32,000	11,840	1,600	800		86,280		
Mianeapolis	5,000	2,000	31,500	18,800	1,600	1,000		114,900		
Helena			6,000	2,400	1,050	600		17,050		
Kansas City	25,000	14,000	40,000	20,000	4,000	2,000		105,000		
Denver	60,000	12,000	30,000	16,800	3,000	2,400		124,200		
Ohlehoma City	8,500	2,000	8,500	4,800	1,000	500		25,300		
Canaha	30,000	3,000	13,000	6,000	1,400	750		36,650		
Dallas	8,500	3,600	5,000	2,400	400	200		85,800 20,100		
El Paso	15,000	6,000	6,000	4,000	1,200	300		32,500		
Houston	10,000	7,000								
Son Antonio	25,000	8,000	10,000	4,800	1,600	700		34,100		
San Francisco	20,000	12,000	20,000	16,000	4,000	2,000		75,000		
Los Angeles	20,000	6,000	20,000	10,000	4,000	3,000 1,000		71,000		
Portland	20,000	6,000	11,000	6,000	3,000 1,400	1,400		60,000		
Salt Lake City	30,000	6,000	20,000	8,000	2,000	1,000		45,800 67,000		
Seattle	50,000	0,000	20,000	0,000	2,000	2,000		07,000		
Total	1,127,600	494,800	1,005,000	570,240	88,150	45,100		3,330,890		
										-

TABLE 6

#### TOTAL RETAIL TRADE IN DOLLAR VOLUME

Year	(Millions of Coins) Cents Net Payout	Cents Cumulative	(\$ Million) Retail Trade	(\$ Million) Charge Accounts	(\$ Million) Coin Intensive
			2.0.0		
1942	1032	1032			
1943	1021	2053			
1944	1454	3507	507.3		
1945	1698	5205			
1946	1466	6671			
1947	978	7649	84864	2381	3023
1948	635	8284	90731	2722	3327
1949	479	8763	88800	2854	3545
1950	629	9392	92938	3367	3769
1951	1182	10574	102069	3700	3929
1952	812	11386	107083	4130	4221
1953	1239	12625	108723	4274	4430
1954	548	13173	110962	4485	4515
1955	738	13911	116873	4795	4669
1956	1405	15316	123919	4995	4895
1957	1294	16610	131650	5146	5000
1958	931	17541	136944	5060	5209
1959	1542	19083	143805	5104	5708
1960	2292	21378	148969	5329	6059
1961	2256	23634	151690	5324	6285
1962	2556	26190	160669	5684	6595
1963	2559	28749	166739	5903	6931
1964	2854	31603	177277	6195	7253
1965	2995	34598	189942	6430	8097
1966	3291	37889	205655	6686	8966
1967	3339	41228	213636	6968	
1968	4036	45264	229079	7755	
1969	5284	50548	238854	8234	
1970	5243	55791	254877	8850	
1971	5304	61095			
1972	5603	66698			
1973	6663	73361			
1313	0000				

<sup>\*</sup>Derived from Morrison Study Data

# Gross National Product (\$ Billion)

1950		284.8
1951		328.4
1952		345.5
1953		364.6
1954		364.8
1955		398.0
1956		419.2
1957		441.1
1958		447.3
1959		483.7
1960		503.7
1961		520.1
1962		560.3
1963		590.5
1964		632.4
1965		684.9
1966		749.9
1967		793.9
1968		864.2
1969		930.3
		077 1
1970		977.1
1971		1,055.5
1972		1,155.2
1072	т	1 2/2 5%
19/3	1	1,242.5* 1,271.0*
	II	1,2/1.0"

\*Seasonally adjusted annual rates

# STATE & LOCAL GOVERNMENT REVENUE FROM SALES & GROSS RECEIPTS TAX (millions of \$)

1946	 2,986	1959	 10,437
1948	 4,442	1960	 11,849
1950	 5,154	1961	 12,463
1952	 6,357	1962	 13,494
1953	 6,927	1963	 14,456
1954	 7,276	1964	 15,762
1955	 7,643	1965	 17,118
1956	 8,691	1966	 19,085
1957	 9,467	1967	 20,530
1958	 9,829	1968	 22,911
		1969	 26,519

Source: Historical Statistics of the U.S., Depart-

ment of Commerce

Statistical Abstract of the U.S., Depart-

ment of Commerce

TABLE 9

### POPULATION FIGURES - ESTIMATES AS OF JULY 1 (IN THOUSANDS)

	TOTAL INCLUDING	TOTAL	CIVILIAN
	ARMED FORCES	RESIDENT	RESIDENT
YEAR	OVERSEAS	POPULATION	POPULATION
1950	152,271	151,868	150,790
1951	154,878	153,982	151,599
1952	157,553	156,393	153,892
1953	160,184	158,956	156,595
1954	163,026	161,884	159,695
1955	165,931	165,069	162,967
1956	168,903	168,088	166,055
1957	171,984	171,187	169,110
1958	174,882	174,149	172,226
1959	177,830	177,135	175,277
1960	180,671	179,979	178,140
1961	183,691	182,992	181,143
1962	186,538	185,771	183,677
1963	189,242	188,483	186,493
1964	191,889	191,141	189,141
1965	194,303	193,526	191,605
1966	196,560	195,576	193,420
1967	198,712	197,457	195,264
1968	200,706	199,399	197,113
1969	202,677	201,385	199,145
1970	204,879	203,810	201,722
1971	207,049	206,230	204,254
1972	208,842	208,230	206,457
1973 a)	210,284	209,724	207,971

a) Figures shown thru June 1, 1973

SOURCE: Population Estimates and Projections
Series P-25, Nos. 456, 482, and 503,
U. S. Department of Commerce

#### AGE DISTRIBUTION OF U. S. COIN

YEAR	CENTS	NICKELS
1973	148	30
1972	110	56
1971	91	45
1970	93	58
1969	42	27
1968	43	6
1967	25	3
1966	15	20
1965	13	6
1964	41 mg of the continue to	140
1963	12	18
1962	14	28
1961	23	12
1960	10 need by the country of	13
1959	the control of the control of the state, the control of the state of t	6 7
1958	estates for 4000 been added 10 the countries. In	- 4
1957	1 2	3
1956		
1955		3
1954	0	7
1953		2
1952		2
1951	0	0
1950 1949	by the transport Continues, by 1 tonger and my hard	2
1949	0	5
1947	December of the contract of th	6
1946	heartiful and tenant of a all demonstration and a	6
1945	the property of the colored	4
1944	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	8
1943	0	14
1942	Oncore destrict on on	4
1941	letter the terminal con 0 of discriberios as	3
1940		4
1939	The district Colones, by Lower, and Br. Spul	3
Foreign	4	0
•	The state of the s	558*
	700	230^

<sup>\* 1</sup> coin each missing from Dr. Hunter's and Dr. Goldman's Sample.

## FUTURE CENT DEMAND AND MATERIALS STUDY COMMITTEE September 6, 1973

The Study Committee convened at the second floor conference room at 1331 G Street, N. W., Washington, D. C. Present at this meeting were: Mr. R. Schmidt, Mr. C. W. Smith and Mr. H. Hervey, Office of the Secretary of the Treasury; Mr. J. Stull, Federal Reserve Board; and Dr. A. Goldman, Mr. F. DeLeo, Ms. D. Duke, and Mr. W. Murphy, Bureau of the Mint.

Dr. Goldman announced at the beginning of the meeting that the project outline had been endorsed by all the responsible authorities (see copy attached) and that Mr. Stull and Mr. Hervey would replace Messrs. Ring and Burhop, respectively. Due to Mr. Bresnick's recent acceptance of a position with the Mint, he will be replaced by Mr. C. W. Smith, of the Office of the Secretary of the Treasury. Ms. D. Duke, the Mint's new Marketing Specialist, has also been added to the committee. The full committee is listed on the attached Project Outline.

Dr. Goldman then suggested that the committee be broken down into four sub-committees as follows:

- A. Sub-Committee One--will conduct the new alloy study as shown in item number one under Scope of Study in the Project Outline. The members of this sub-committee will be: Dr. Goldman, Chairman, Dr. Hunter and Mr. Murphy.
  - B. Sub-Committee Two--will study feasibility, acceptability, benefits and impact of a new denomination and alloy on the general public. The members of this sub-committee will be: Ms. Duke, Chairman, Mr. Hervey and Mr. Stull.
- C. Sub-Committee Three--will conduct studies on coin demand forecasting, inventory control, distribution and consumption. The members of this Sub-Committee will be:

  Mr. Schmidt, Chairman, Dr. Hunter, and Mr. Stull and Mr. DeLeo. A meeting of this sub-committee will be held in the Global Building, 1025 Vermont Avenue, on September 13, 1973, at two o'clock in Mr. Schmidt's office.
  - D. Sub-Committee Four--will conduct studies on the implications of all the above studies on the new Denver Mint. The members of this sub-committee will be: Mr. Smith, Chairman, Dr. Goldman and Mr. Hervey.

Each sub-committee should meet at least once every two weeks and will present their findings and/or conclusions at the regular monthly committee meeting. Dr. Goldman will be responsible for coordinating the efforts of all the sub-committees.

Dr. Goldman's recent trip to Europe afforded him the opportunity of studying Finland's successful change-over from a bronze piece to an aluminum piece in their monetary system. This was accomplished eight years ago and both the bronze and aluminum coins are in circulation. While there was a minor initial reaction from the public, there was no major withdrawal of the bronze piece. Dr. Goldman distributed an uncirculated aluminum piece to Ms. Duke, Mr. Schmidt, Mr. Stull and Mr. Hervey, who will carry it to determine how well it holds up over a period of several months.

Finland buys its own strip. The blanks are coined without an annealing or softening treatment. Sub-Committee One will look into the feasibility of their alloy and other aluminum alloys as possible replacement materials for penny bronze.

Italy has a larger aluminum piece than Finland and produces their own strip, using equipment that is not too different from that used to produce bronze strip. Since tentative plans call for the new Denver Mint to fabricate 32-inch wide strip, it was suggested that Sub-Committee Four visit a few aluminum sheet mills to determine whether equipment purchased to produce bronze could be used (with some modifications) to economically produce an aluminum alloy at the new Denver Mint.

A Treasury Department Management by Objectives Statement has been drafted by Mr. Schmidt and Mr. Bresnick. The draft statement (attached) contains minor revisions of target dates and is presently being circulated for approval by Assistant Secretaries Brecht and Morgan.

Dr. Hunter and Mr. Schmidt have studied the material submitted at the last meeting and plotted the different variables versus net payouts. Copies of some of their graphs were distributed to members of Sub-Committee Three. They will determine which of the variables correlates with net payout and which variable, if any, is predictable enough to be more useful than a simple semi-logarithmetic extrapolation of new payout versus time.

With respect to the penny and nickel sample taken by the committee members to determine loss rates and the number of pieces in circulation, the data indicates a pool of approximately 21 billion pennies with a 12.6% disappearance rate. This data assumes that the Washington area is representative of the country as a whole, and is heavily biased toward coins of recent date. It is expected that a more representative sample will be provided by the Sears and Roebuck Company survey which will be handled by the Mint's Marketing Specialist, Ms. Duke, and Dr. Goldman.

This survey will provide information on the dates of particular coins taken from cash registers of certain geographically located Sears and Roe-

buck outlets. It is felt that this will be an improvement over the A. D. Little and other studies, which attempted to establish accurate disappearance rates and the number of coins in circulation, because their data was received from the Federal Reserve Banks. The bank data were probably biased toward coins of recent date, such as in our own survey.

Mrs. Brooks has been in touch with the Treasurer of Sears and Roebuck, who suggested that Dr. Goldman contact the Assistant Treasurer for Northeast Operations. Ms. Duke will review the form Dr. Goldman has set up for the survey with regards to number of coins, store size to be used and locations. Sears will also be asked to provide information on the approximate inventory of coins required in stores of various sizes and may be asked to assist in the study on the acceptability of a new denomination and/or alloy. A meeting between Dr. Goldman and Ms. Duke will be held on Monday, September 10, 1973, to discuss the survey form and to contact Sears concerning a possible meeting in Philadelphia with Sears and Roebuck's officials.

The lack of adequate coin storage facilities in the Western States was mentioned by Mr. Stull and Mr. DeLeo as a factor which makes it difficult to react to rapid unforecasted demand changes by simply varying the coinage inventory level. It was suggested that an unused aircraft manufacturing facility on the West Coast might be available for this purpose.

It was suggested that the FRB request commercial banks to forecast their coin needs on a regular basis in order to improve short term (less than one year) forecasting and production planning. Mr. Stull agreed to discuss the feasibility of this proposal with FRB officials.

Mr. Stull submitted a table on the minimum operating coin inventory at Federal Reserve Banks by denomination. He has not received any word as yet from the Canadian Banking Association concerning the U. S. cent in Canada, and is still gathering data concerning the necessary inventories to stock a commercial bank branch. The latter survey will focus on three different size head offices and a branch of each.

Mr. Stull will attempt to provide Ms. Duke with any reports the Federal Reserve Board might have concerning the experience of the \$2 bill. This is to be accomplished before the next Study Committee meeting.

Mr. Schmidt provided information on the growth of cash registers since 1950.

Mr. Hervey will attempt to provide the committee with forecast data on GNP. It was suggested that he contact the Wharton School of Finance at the University of Pennsylvania in Philadelphia, which has been doing GNP

forecasts. He will also check that Mr. Clawson agrees on the classification of the Minutes as "Official Use Only".

Mr. DeLeo is gathering information on penny usage in parking meters and vending machines. He will make an interim report at the September 13 Sub-Committee Three meeting. The possible criticality of cent size and weight is one item on which Mr. DeLeo is concentrating.

The Bureau of Mines, Department of the Interior, has provided supply-demand material on copper, iron, aluminum and other materials. This information will be studied in-depth by Sub-Committee One.

A correction in the minutes of the August 23, 1973, meeting was made by Dr. Goldman concerning the circulation of the aluminum coin produced by the Mint for the Philippine government. Orders of 12 million for 1968 and 130 million for 1969 were placed simultaneously and no new production requests have been made since that time.

Dr. Hunter is still in the process of obtaining information concerning the possibility of lower density pennies being counted in sorting machines as a higher denomination.

Dr. Goldman stressed the importance to all committee members of <u>not</u> alerting the general public to the possibility of any coinage change. In contacting any sources of information, it was stressed that the committee members should state that this is part of a continuing study conducted by the Treasury Department to look at the nation's coinage from the point of view of forecasting production requirements and maximizing the Bureau of the Mint's operating efficiency.

The next meeting of the Study Committee will be held on Tuesday, October 9, 1973, at 10:00 A. M., in the second floor conference room at 1331 G Street, N. W., Washington, D. C.

Attachments

W. J. Murphy/A. J. Goldman September 10, 1973 OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6
UNITED STATES GOVERNMENT

Memorandum

FOR OFFICIAL USE ONLY

Edward L. Morgan, Asst. Secretary of the Treasury

TO Warren F. Brecht, Asst. Secretary of the Treasury

E. Maurice McWhirter, Assoc. Director, FRB Operations

FROM : Frank H. MacDonald <

Deputy Director of the Mint

SUBJECT: Approval of Project Outline

Attached is a project outline for the study of future cent demand and materials. The study will address the questions of alternate materials and denominations, as well as future demand, and the results of the study will have a direct impact on our plans for the strip production facility at the new Denver Mint.

The outline was prepared by the Study Committee whose members are listed on page 2. Please indicate your approval of the outline by affixing your signature on the appropriate line on page 3 or, alternatively, if you have any questions regarding the outline, please contact either the Committee Chairman or your representative on the Study Committee.

Attachment



Decision of the activities, excesse, and it will be a

#### A Study of Future Cent Demand and Materials

#### Statement of Problems

1. Potential negative seigniorage and hoarding of cent.

2. Implications on new Denver Mint strip facility.

 Lack of satisfactory short term (as related to production scheduling and inventory requirements) and long term (as related to coining capacity requirements) demand forecasts.

#### Scope of Study

1. Test and analysis of promising substitute cent materials including changes in size and copper content.

 Study of the feasibility, acceptability, and benefits and impact of an additional coin denomination between the l¢ and 5¢ pieces.

- Analysis of the coin distribution and consumption system to improve our ability to predict short and long range coin demands.
- 4. Forecast of cent requirements for 1980-1990.
- 5. Recommendation of strip production or storage facility for the new Denver Mint.
- 6. Recommendation for new coinage legislation.

#### Methodology

- 1. Alternate cent materials and sizes.
  - a. Review of potential high feasibility materials with respect to raw material availability and costs, strip and coinage production costs, ease of fabrication, acceptability, longevity, compatibility with present coinage, counterfeiting potential, energy consumption and vending machine use.
  - b. Perform preliminary screening of available alloys and establish a priority list of high feasibility materials.
  - c. Perform laboratory scale coin fabrication studies on several high feasibility materials and sizes.
  - d. Perform pilot scale coin fabrication studies on the most promising of the high feasibility materials and sizes above.
  - e. Present samples for review and approval by Treasury and Federal Reserve System officials.

#### 2. Demand Analysis

a. Review the coin ordering, storage, and distribution system and past bank usage data.

- b. Attempt to correlate coin usage with certain selected short and long range economic and expenditure indicators.
  - Determine the number of coins in circulation, by denomination.
  - Determine the coin loss rate, particularly of cents.
- c. Perform a market analysis of the acceptability and impact of a new coin denomination on demand.
- 3. Review the impact of the above on long term coining, strip production and storage capacities.

#### Schedule

Complete laboratory scale cent alloy study, November 1, 1973. Complete pilot scale most promising alloy study, April 1, 1974. Complete impact of new coin denomination study, January 1, 1974. Complete cent demand study, February 1, 1974. Complete final report and recommendations, June 1, 1974.

#### Staffing

Members of the study committee will be as follows:

Bureau of the Mint
Dr. Alan J. Goldman - Chairman
Dr. George E. Hunter
William J. Murphy
Deborah A. Duke
Francis R. DeLeo

Office of the Secretary of the Treasury Richard Schmidt Homer V. Hervey C. William Smith, Jr.

Board of Governors of the Federal Reserve System James L. Stull

Approved:	Assistant Secretary for Administration
Date:	AUG 3 1 1973
Approved:	Assistant Secretary for Enforcement, Tariff and Trade Affairs and Operations
Date:	8/20/73
Approved:	Associate Director, Division of Federal Reserve Bank Operations Board of Governors of the Federal Reserve System
Date:	9/5/23
Concur:	Director of the Mint
Date:	8/31/73

#### DRAFT/MANAGEMENT BY OBJECTIVES STATEMENT

#### Objective

An approved program plan for efficiently meeting the demand for fractional currency below the five-cent piece through 1990.

#### Justification

Two problems of growing concern compel a fundamental examination of alternative methods of satisfying demand for cents. The first problem is the increasing cost of copper, which threatens to eventually cause the intrinsic value of the coin to exceed its face value. When this point is reached, private hoarding will occur. The second problem is the growing demand for pennies, a demand that has exceeded prior long range forecasts by as much as 50%. The demand problem will be exacerbated by the problem of negative seigniorage, should that occur. The primary difficulty is not simply that demand has been growing, but that its rate of growth has been largely unpredictable, despite a number of efforts aimed at development of forecasting models.

A committee has been formed under the direction of the Mint to define and analyze alternative methods of satisfying that growing demand. Alternatives to be explored include the following:

- · Alternative metal alloys;
- Additional pieces between the one and five-cent pieces,
   e.g., a two-cent piece;
- · Alternative demand and/or production control models.

Part of the data will be used to support the design effort underway for the new Denver Mint. The primary objective of the study, though, will be to define the decision alternatives (including legislative implications) and to provide adequate decision criteria and supporting data for long range planning of Mint operations regarding penny production. It would be useful, further, to consider this study as the first step in development of a more effective and continuing long range planning process for the Mint.

#### Action Responsibility

Brooks Morgan \* Brecht

Output Milestones		Estimated Completion  Date	Responsibility
1.	Metal alloy alternatives defined.	November 1, 1973	Goldman/Mint
2.	Demand forecast for one- cent piece through 1990.	February 1, 1974	Wolf/OMO
3.	Viability of new coin denomination and material defined.	March 1, 1974	Goldman/Mint
4.	Pilot scale studies on most promising alloys completed.	April 1, 1974	
5.	Alternative forecasting/ production control/distri- bution models defined.	April 1, 1974	Wolf/OMO
6.	Final recommendation of Committee	June 1, 1974	Goldman/Mint
7.	Complete briefing of appropriate Treasury Depart- ment, Federal Reserve, and Congressional officials	July 30, 1974	Goldman/Mint
8.	Formulate plans for appropriate legislation	August 30, 1974	Goldman/Mint
9.	Complete draft of proposed legislation.	September 30, 1974	/Mint

FR 186 (Rev. 7-71)

-								
-	CENTS	NICKELS	DIMES	QUARTERS	HALVES	DOLLARS	TOTAL	•
Boston.	45,000	24,000	43,000	36,000	1,600	200	149,800	
New York	40,000	20,000	30,000	12,000	800	400	103,200	
Buffalo	15,000	3,000	6,000	3,200	1,400	800	29,400	
Philadelphia	20,000	8,000	15,000	8,000	2,000	500	53,500	
Cleveland	39,100	5,360	8,500	9,800	1,500	750	65,010	
Cincinnati	40,000	10,000	20,000	12,000	1,000	500	83,500	
Pittsburgh	12,000	8,000	20,000	10,000	1,200	600	51,800	
Richmond	8,000	2,000	8,000	3,200	800	400	22,400	
Baltimore	5,000	4,000	5,000	4,000	400	200	18,600	
Charlotte	7,000	3,000	6,000	3,200	800	400	20,400	
Culpeper								
Atlanta	30,000	18,000	25,000	16,000	2,000	1,000	92,000	
Birmingham	8,700	2,000	6,000	3,200	600	400	20,900	
Jacksonville	10,000	4,000	15,000	6,000	1,000	500	36,500	
Miami	5,000	2,680	7,500	4,000	400	100	19,680	
Nashville	5,000	2,000	3,000	1,600	200	100	11,900	
New Orleans	10,000	10,000	10,000	6,000	1,000	500	37,500	
Chicago	50,000	10,000	30,000	24,000	6,000	3,000	123,000	
Detroit	20,000	9,000	16,000	13,600	1,600	800	61,000	
St. Louis	10,000	4,000	10,000	6,000	200	100	30,300	
Little Rock	7,500	1,500	2,500	2,000	300	75	. 13,875	
Louisville	15,000	14,000	10,000	8,000	300	150	47,450	
Memphis	15,000	8,000	18,000	7,200	400	100	48,700	
Minneapolis	20,000	8,000	20,000	12,000	,700	500	61,200	
Helena.	2,500	1,500	3,500	1,400	700	350	9,950	
Kansas City	16,000	14,000	30,000	14,000	4,000	1,000	79,000	
Denver	20,000	4,000	20,000	5,600	1,000	800	51,400	
Oklahoma City	3,000	1,000	5,000	2,000	400	200	11,600	
Omaha	8,000	2,000	7,000	3,200	800	300	21,300	
Dallas	10,000	4,000	10,000	8,000	800	400	33,200	
El Paso	4,400	2,680	3,000	1,600	200	200	12,080	
Houston	10,000	4,000	4,000	1,600	600	100	20,300	
San Antonio	6,500	5,000	7,000	3,600	1,400	600	24,100	
San Francisco	15,000	5,000	10,000	8,000	2,000	1,000	41,000	
Los Angeles	10,000	6,000	10,000	8,000	1,000	1,000	36,000	
Portland.	10,000	3,000	3,500	5,000	1,500	500	23,500	
Salt Lake City	6,500	2,000	10,000	1,800	400	350	21,050	
Seattle	15,000	4,000	6,000	4,000	500	250	29,750	
à	574,200	238,720	463,500	278,800	41,500	19,125	1,615,845	
Total					WINDS HAVE THE			

Future Cent Demand and Materials Study Committee Meeting-August 13, 1973

The Study Committee convened at the second floor conference room at 1331 G Street N.W., Washington, D.C. Present at this meeting were Mr. G. Burhop and Mr. R. Schmidt, Office of the Secretary of the Treasury, Mr. J. Stull, Federal Reserve Board and Dr. A. Goldman, Dr. G. Hunter, and Mr. W. Murphy, Bureau of the Mint.

of the study and delegate responsibility for gathering the initial data.

The delegation of responsibility is as follows:

The Federal Reserve Board representative will provide:

- The name of a Federal Reserve Board Official who will endorse the project outline.
- The total number of savings and commercial banks and their branches and the number of Savings and Loan Associations and branches in the United States by year from 1950-1973.
- Information concerning the number of coins by denomination necessary to stock a new savings bank branch, taking into consideration geographical location.
- 4. Information concerning the storage capacity and inventories of the Federal Reserve Banks and Branches by denomination showing maximum and average figures.
- Information concerning the usage of the United States cent in Canada.

#### Mr. R. Schmidt will provide:

- 1. Total retail sales in both dollar volume and total number of transactions by year from 1950 to 1973.
- Total number of cash registers and cash drawers sold by all register manufacturers by year from 1950 to 1973.

#### Mr. G. Burhop will provide:

- 1. Actual GNP data vs. Fiscal Year by year from 1950 to 1973.
- 2. GNP forecast data on a 5 and 10 year basis for the years 1950 to 1973. This is to be compared with actual GNP data.

- 3. Number of credit card transactions and total credit card dollar volume by year from 1950 to 1973.
- 4. State and Local Sales Tax Revenue by year from 1945 to 1973.

#### Dr. G. Hunter will provide:

- Information regarding total coins used in vending machines by denomination by year from 1950 to 1973. This information is to include figures on toll machines and penny parking meters if such data is available.
- Sources to be pursued to determine availability of copper, aluminum, iron, etc., from domestic and foreign sources. Projected U.S. demand data is also to be obtained.
- Information on future supply and demand of refined copper and aluminum by contacting the Copper Development Association and Aluminum Association.
- 4. Information concerning the aluminum coins produced by the Bureau of the Mint for the Philippines
  Government.

#### Dr. A. Goldman will:

 Try to arrange for random sampling of coins (by date) located in cash registers of a certain number of Sears and Roebuck outlets to be chosen by population of the area in which they are located.

#### Mr. W. Murphy will provide:

1. Population figures by year from 1950 to 1973.

All data should be compared (i.e., plotted linearly and/or semi-logarithmically vs. time) to historic net payout data which was distributed.

It was also suggested that the Mint's new Marketing Specialist would conduct an acceptability study of the two cent piece and any change in appearance of the cent. The Mint's Legal Counsel is looking into the feasibility of test marketing a two cent token in a small town.

The Bureau of the Mint is also in the process of studying alternate cent materials and sizes by reviewing potentially high feasibility materials. Preliminary screening of available alloys and laboratory scale coin fabrication studies have commenced.

All members present at the meeting will obtain four dollars in nickels and one dollar in pennies from a savings bank or Savings and Loan Association and list the dates of each coin. An attempt will then be made to exchange the unrolled coins for dollar bills.

A discussion was also held concerning the importance of not alarming the general public to the possibility of any coin change or shortage. This study is merely a continuing process of the Treasury Department to look at coinage and constantly update new methods and alternatives for measuring demand and supply criteria.

The next meeting of the Study Committee will be held on Thursday, August 23, 1973 at 10:00 A.M. in the second floor conference room at 1331 G Street N.W., Washington, D.C.

W.J. Murphy/A.J. Goldman August 15, 1973

# Memorandum

Edward L. Morgan, Assistant Secretary

Warren F. Brecht, Assistant Secretary

EROM : Frank H. MacDonald

Deputy Director of the Mint

SUBJECT: Potential One Cent Negative Seigniorage

In the past six months, the metal value in the one cent piece has increased from less than .4¢ to approximately .6¢ as the price of copper has risen from 50.0¢ to 91.6¢ per lb. When one adds our manufacturing and transportation costs of .2¢ to the present raw material cost, it becomes evident that we must be prepared for the possibility that the price of copper will increase to a point (approximately \$1.20 per lb.) where the seigniorage for cents is negative (i.e., total cost exceeds face value). Should the copper price at some future date exceed \$1.51 per lb, the value of the raw material will exceed the face value of the coin and the public will hoard one cent pieces as they did the silver coins in the early 1960's.

July 23, 1973

#### PROPOSED STUDIES

- A review of alternative coinage materials having lower an material cost and more favorable supply-demand projections compared with the present 95% copper 5% zinc alloy has been initiated by the Office of Technology of the Bureau of the Mint. Attachment 1 is a list of criteria which which be applied in evaluating the proposed materials listed in Attachment 2. Samples of the materials judged to have migh feasibility are being procured for preliminary evaluation. It is estimated that six months will be required for a complete evaluation of the alternative coinage materials.
- 2. Other possible approaches to the potential problem of negative one cent seigniorage include:

a) reducing the size of the one cent piece.

b) revaluating the one cent piece to two cents.

c) issuing a two cent piece in addition to a smaller one cent piece.

In order to crystallize the possible effects of these approaches and, at the same time, assist the Mint in its long and short range production planning, it is suggested that a study of future cent requirements be made by a team including representatives of the Office of the Secretary of the Treasury, Bureau of the Mint and the Federal Reserve Bank. A proposed outline for such a study is appended as Attachment 3.

#### IMPACT ON PLANS FOR NEW DENVER MINT

In view of the reasonable probability that the nature of the one cent coin (which presently accounts for 75 - 80% of our total output) will be changed within the next 15 years, the Bureau of the Mint faces the following alternatives with regard to the design of the new Denver Mint.

- Proceed as planned to date. That is, construct a production facility for penny bronze strip in addition to a new coinage facility.
- Hold the Denver Mint project in abeyance for six to nine months until the proposed studies have been completed.
- 3. Proceed with site preparation and design of a new coining facility. Locate the coining facility on the site in such a manner that either a strip storage building or a strip production facility can be added as a second phase to the project.

We recommend that alternative three be implemented. Further delay in the design and construction of a new coinage facility could jeopardize the Mints' ability to satisfy the nation's coinage demands after 1980. Since the nature of the strip production facility would differ markedly depending on the material which is utilized for the cent, serious consideration must be given to a greater reliance on strip purchased from the private sector. This may be preferred rather than risk construction of an expensive strip production facility which would be obsolete shortly after it was completed. With your concurrence, we will prepare revised planning criteria and funding schedules for the new Denver Mint based on implementation of alternative three.

Attachments

#### Criteria for One Cent Alloy

- 1. Cost (vs. face value) and Availability (U.S., U.S. and Canada, World)
  - A. Raw Materials present cost, long term projected cost based on supply vs. demand projection.
  - B. Strip Manufacturing or Procurement Cost
  - C. Coin Manufacturing Cost
- 2. Public Acceptability
  - A. Weight
  - B. Color and Reflectivity
  - C. Toxicity
- 3. Ease of Fabrication using Present and Projected Equipment
  - A. Strip
  - B. Coins (including die life considerations)
- 4. Wear and Corrosion Properties
- 5. Compatability with Present Coinage (side by side) to Minimize Impact of Change (i.e. minimize withdrawal rate)
- 6. Counterfeiting Potential
- 7. Energy Consumption
- Vending Machine Use

Note: Any proposed coin size change will have to be viewed on basis of interchange problems with coins of Canada, Mexico and others.

#### Alternative Materials for One Cent Coinage

- 1. Copper-zinc alloys containing 10 to 30% zinc.
- 2. Chromized steel.
- 3. Aluminum alloys containing magnesium or manganese.
- 4. Copper alloys clad or plated on steel.
- 5. Zinc-copper and zinc-aluminum alloys.
- 6. Plastics.

Items 1-3 are considered to have high feasibility when evaluated against the criteria.

Items 4-6 have low feasibility.

Several other clad combinations (eg. aluminum clad steel, copper-nickel clad zinc, stainless steel clad aluminum, and nickel clad steel) have been reviewed and judged either technically or economically unfeasible.

## Memorandum

TO : F. H. MacDonald

DATE: July 16, 1973

FROM : A. J. Goldman

SUBJECT: Objectives for Study of Future Cent Requirements

- 1. Demand forecast 1980, 1985, 1990 (1¢ Total pieces for all denominations).
- 2. Recommended total (Mint and Federal Reserve Banks) inventory size based on short range demand fluctuations and planned storage capacity increases.
- 3. Repeat 1. with 1¢ piece value upgraded to 2¢.
- 4. Repeat 1. with 2¢ piece in addition to 1¢ piece.
- 5. Effect on 1. and 2. of changing material or size of 1¢ piece.

#### To satisfy objectives we must determine:

- a. No. pieces (by denomination) in circulation.
- b. Loss rate for each denomination.
- c. Trends of:

Coin demand vs. time

GNP vs. time

Total no. branch banks vs. time

Total no. credit card transactions vs. time

Total no. cash registers sold vs. time

Coins in vending machines (by denomination) vs. time

- d. Net payouts vs. time from 1940 including breakdown of sources of payouts
- e. Coin storage capacities
- f. Effect of new bicentennial coins on short term demand (applicable only if study is extended to denominations beyond le piece)



## CHROMIZED STEEL SHEET

# Chromized Steel Sheet for the corrosion resistance of stainless steel at much less cost

Typical Composition of Base Steel

C Mn P S Si Ti 0.05 0.30 0.008 0.017 0.018 0.36 Chromized Steel is a ferritic stainless steel coating on a carbon steel base. The ferritic stainless coating is uniform, continuous, ductile, and integral with the steel. It cannot be mechanically stripped from the steel base.

The steel sheet is a titanium-stabilized, low-carbon sheet developed to insure acceptable grain size and low carbon content in the coating for maximum corrosion resistance and coating ductility.





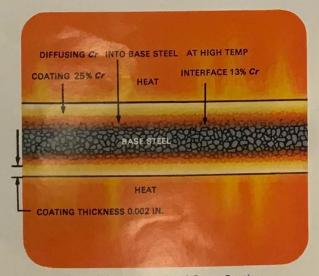
## Outstanding in Oxidation and Corrosion Applications

Chromized Steel sheet can be used, in general, in all applications where a 400-series ferritic stainless steel has been successfully used.

Chromized can be used continuously in air up to 1400 F, with intermittent service up to 1500 F. Thus it is suitable for such applications as heat exchangers, oven fixtures, burners.

Because it is highly resistant to oxidizing environments, industrial atmospheres, flue-gas condensates, exhaust gas condensate, continuous wetness, and certain agricultural chemicals, Chromized can be economically used for mufflers, furnaces, electrostatic precipitators, silos, and industrial roofing.

Chromized can be furnished in a dull, non-reflective matte finish, or in a brushed finish with reduced surface roughness and a reflectivity approximating a general-purpose cold-rolled finish.



Typical Chromized Steel Cross Section



A large manufacturer of heating and air-conditioning equipment has found that Chromized sheet provides drawing and welding advantages over the previous material, as well as excellent corrosion resistance. It also returned a saving of \$10,000 per month in material costs.



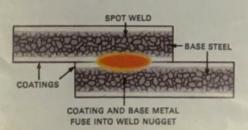
Chromized spot welds readily in the manufacture of gas heaters especially designed for mobile homes. The operating temperatures of 1,200 F are well within the range of Chromized Steel.



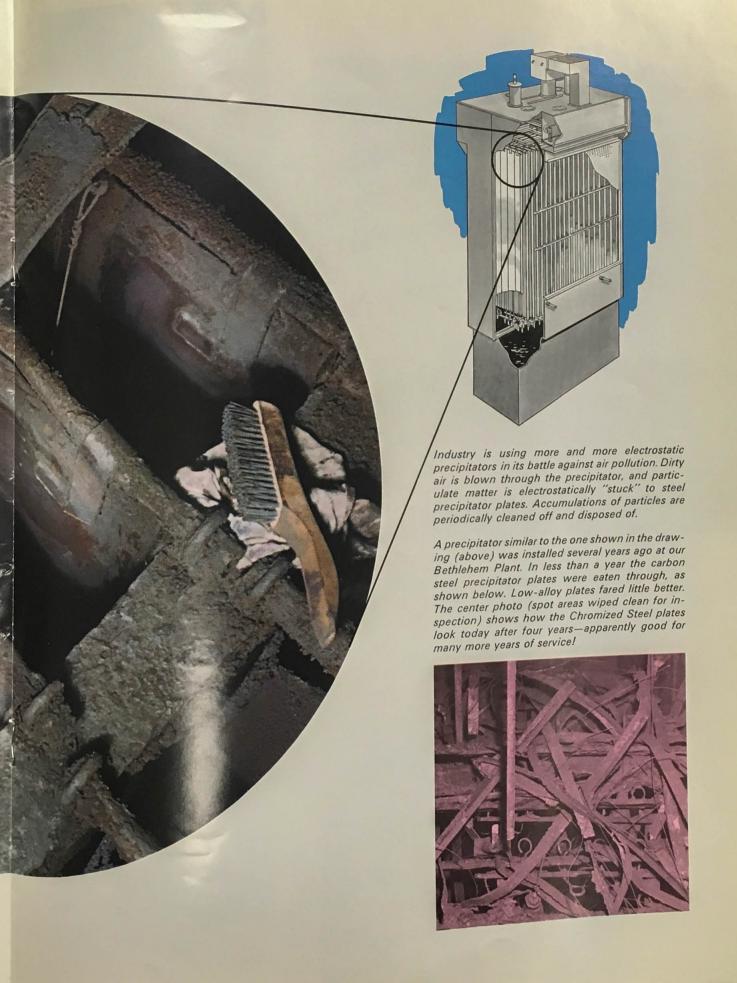
#### Two Advantages over Stainless

Bethlehem's new Chromized Sheet Steel has two major advantages over homogeneous ferritic stainless.

- ECONOMY—it carries a substantially lower price tag. Some customers report savings of 25 to 50 percent and more over previously used material.
- EASE OF FABRICATION—since Chromized Steel is essentially carbon steel, it can be fabricated by conventional carbon steel methods.
  - a) FORMING—Being ductile and diffusionbonded, the coating will not flake or spall during forming. (See ductility demonstration on back page.) Can take 180° flat bend without cracking coating.
  - b) JOINING—Chromized sheet can be welded, brazed, and soldered. Spot welding can be done without destroying the integrity of the coating, and with tip life equivalent to that obtained with low-carbon sheet. (See "Typical Welding Conditions.") With other welding processes, corrosion resistance across the joint can be maintained by using appropriate stainless steel filler metal or by special techniques for alloy enrichment of the weld area.











Silage is highly corrosive. Chromized Steel sheet is proving to be an economical solution to the problem, because it performs as well as stainless, yet costs much less.

Chromized Steel has excellent resistance to heat oxidation up to 1,400 F so it is an ideal choice for burners, self-cleaning ovens, combustion chambers and heat exchangers.





The welding of Chromized sheet presents no special problems. (See "Typical Welding Conditions," back page.)





In automobile mufflers Chromized has exhibited corrosion resistance comparable to that of much more expensive materials. At right is a muffler (sectioned lengthwise to show the interior) which endured 41,900 miles of stop-and-go driving over a 5-year period. Though stained and dirty, it is still virtually as sound as the day it was installed!

Chromized Steel performs well in the shop, including difficult drawing operations, without damage to the coating.





#### Typical Mechanical Properties

#### 20-GAGE CHROMIZED SHEET

Yield Strength (psi) Tensile Strength (psi) Total Elongation Uniform Elongation Olsen Cup Height Hardness 22,000-32,000 40,000-48,000 30-37% 18-22% 0.350-0.425 in. 42-52 R<sub>B</sub> 1. Here's a cup of Chromized sheet which we have deep-drawn from a blank like the round one beneath it.

#### How's this for ductility?



2. Now we etch away all the base steel in boiling 20% nitric acid...

3. ... and look what's left: two perfect cups composed solely of the chromized coating material, completely free of holes or acid attack. Surely a convincing demonstration of the ductility and integrity of the coating on Chromized Steel!



#### Size Range

- A. Gages: 14 to 26 inclusive.B. Coil widths: 2 to 41 inches in 14 to 26 gage inclusive.
- C. Sheet sizes:

Gage 14	Width- Inches	Length- Inches		
	41 max	240 max	30 min	
16	41 max	240 max	30 min	
18	41 max	240 max	30 min	
20	41 max	240 max	30 min	
22	41 max	168 max	19½ min	
24	41 max	168 max	19½ min	
26	41 max	168 max	19½ min	

## Typical Welding Conditions— 20-GAGE CHROMIZED SHEET

#### 1. Resistance spot

- a. Electrode diameter -. 20 inch
- b. Electrode force-1,150 lb
- c. Weld time-6 cycles
- d. Welding current-10,000 amp
- Tip life of standard Class II electrode—8,500 welds with no change in nugget size.

#### 2. Metal inert gas

- a. Tight butt joint with copper backing strip.
- b. Type 430 stainless steel (14-18% chromium) .035-inch diameter welding wire. Type 310 stainless steel (24-26% Cr and 19-22% Ni) also has been successfully used.
- c. Shielding gas-argon + 1% oxygen at 30 cu ft/hr
- d. Arc voltage-19 volts
- e. Current-100 amps (D.C., reversed polarity)
- f. Speed-36 in./min

#### 3. Manual tungsten inert gas

- a. Tight butt joint with steel backing strip.
- b. Type 430 stainless steel (14-18% chromium) or 446 stainless steel (23-27% chromium) 1/16-inch diameter wire filler metal. Type 310 stainless steel, as in 2 b, can also be used.
- Welding electrode—2% thoriated tungsten, .040-inch diameter.
- d. Shielding gas-argon at 45 cu ft/hr
- e. Arc voltage-12 volts
- f Current-55 amp. (D.C., straight polarity)

#### 4. Flash (Alloy Metal Injection)

- a. Standard Thompson 50 kva flash welding machine.
- Type 430 stainless steel (14-18% chromium), 1/16-inch diameter wire filler metal.
- c. Initial die opening-5/16 inch
- d. Flash off-1/8 inch
- e. Final die opening-5/32 inch
- f. Upset-1/32 inch
- g. Flash time-2.0 seconds

Bethlehem Chromized Steel has been recognized in the American National Standards, and meets the Military Specification MIL-S-46055A (MR) 29 April 1966 (Amendment 1 of 10 May 1966 and Amendment 2 of 7 June 1966), for Sheet and Strip, Low Carbon, Chromized Steel.

#### BETHLEHEM STEEL

Bethlehem Steel Corporation, Bethlehem, PA 18016



#### BETHLEHEM'S SHEET CHROMIZING PROCESS

By

E. H. MAYER Section Manager;

and

#### R. M. WILLISON

Supervisor, Sheet and Tin Mill Products Section; Homer Research Laboratories Bethlehem Steel Corporation

#### Introduction

THE STEEL INDUSTRY has long recognized the merits of improving the corrosion resistance of its products by coating them with nonferrous metals. The contribution of hot dip and electrolytic coatings to the economic welfare of our industry needs no review for this audience.

Over the years many other types of steel coating processes have been developed which provide a wide range of desirable properties. However, in general these coating processes have not attained a high level of commercial acceptance because they are not well suited to mass production. One of these processes, chromizing, employs high-temperature diffusion of chromium metal into the steel surface to form an iron-chromium alloy coating. The fact that such a coating has corrosion properties generally similar to those of ferritic stainless steels pointed to the economic potential of chromized steel, provided that a chromized coating on low-cost sheet steel could be produced economically on a tonnage basis. Other factors that would enhance the economic potential of such a chromized product would include versatile formability and good weldability.

The chromizing process developed by the Bethlehem Steel Corporation has fulfilled these process conditions and produces a material with a wide range of desirable properties.

The purpose of the present paper is to detail our process; and

since the properties of our chromized steel have already been described in recent Metal Progress articles1,2, a brief listing of these properties will suffice here. In addition to good corrosion resistance, the chromized coating has sufficient ductility and adherence to withstand the most severe forming operations, such as deep drawing and spinning. Furthermore, the coating integrity can be maintained during conventional welding procedures. Thus, coil stock can be coated at the mill and subsequently fabricated into a wide variety of end products.

#### History of Chromizing

A very brief review of the main stages in the history of chromizing development will be of interest before we proceed to the

description of Bethlehem's chromizing process.

Historically, the development of chromizing closely parallels, with respect to time and techniques, the development of the more familiar carburizing process. The first published work on chromizing, by F. C. Kelley<sup>3</sup>, appeared in 1923. Kelley packed steel parts in a powder containing particles of metallic chromium and heated them for several hours in a non-oxidizing environment. Chromium atoms diffused into the steel surface from the chromium particles in direct contact. A corrosion-resistant iron-chromium alloy coating resulted.

Objectionable sintering of the chromium particles to the steel surface, inefficient use of the chromium source material, and difficulty in maintaining non-oxidizing conditions discouraged commercial acceptance of Kelley's process. However, his discovery that an iron-chromium alloy coating can be formed by diffusion at temperatures well below the melting point of either component of the alloy system was an important contribution to coating

technology.

Marshall' reached the next milestone in the development of chromizing in 1927 when he introduced the use of a "carrier compound." The parts to be chromized were packed in a mixture of finely divided ferrochrome, chrome ore, and bleaching powder. The bleaching powder, a chloride of lime, is the carrier compound. As the pack was heated, the bleaching powder vaporized, expelling the air from the pack and reacting with the ferrochrome to form a chromium chloride. In turn, this volatile compound reacted at the steel surface, depositing chromium metal which

diffused into the steel to form the iron-chromium alloy coating.

The main contribution of Marshall's gaseous transport concept was the elimination of sintering. On the other hand, the high labor costs, slow heating rates, and low productivity associated with batch techniques as well as low efficiency in chromium utilization by the process were inherent weaknesses that prevented widespread commercial acceptance.

In a process described by G. H. Howe in 1930, steel parts were chromized without being packed in a chromium containing powder. Instead, the parts were placed in a porous refractory inner chamber which was fitted with an impervious outer chamber. The space between the inner and outer chambers was filled with a mixture of chromium powder, refractory material, and ammonium chloride. Upon heating, ammonium chloride, the carrier compound, decomposed into a mixture of gases containing chromous chloride. Permeating through the porous refractory inner chamber, these gases fill the space surrounding the steel article. Although Howe circumvented some of the problems associated with pack methods, his process had two basic drawbacks in terms of the coating materials: (1) a costly source of chromium was used, and (2) chromium utilization was relatively poor. Furthermore, like previous methods of whatever type, Howe's method was still restricted to the batch technique for fabricated parts.

A further extension of the gaseous transport concept was described in a 1961 article in *Iron Age*. This process, developed by the Gasalloy Steel Corporation, circulates chromium-halogen-containing gases in an essentially closed system between the chromium source material and the opened coil of sheet steel. Although their process represents the useful advance to coil coating as opposed to the batch techniques of earlier methods, it does not fully utilize the chromium source materials.

By contrast, Bethlehem Steel's chromizing process utilizes low-cost ferrochrome sources at virtually 100 per cent efficiency by the device of roll-compacting a precise amount of chromium onto the sheet surface *before* the coils are subjected to a diffusion treatment. However, even more important is the fact that this maximum efficiency in chromium utilization is combined with mass production techniques, a capability that is not offered by most other chromizing processes. Specifically, coils weighing up to

40,000 pounds can be processed in gages and widths needed for a wide variety of fabrication requirements.

#### **Chromizing Process**

The essentials of Bethlehem's chromizing process may be summed up as follows:

- Prior to the diffusion treatment, a precise amount of finely divided ferrochrome powder is applied to the surface of cold-rolled low-carbon steel by roll-compacting.
- Conversion of this roll-compacted layer into a continuous iron-chromium alloy coating is then achieved by heating the open coil at 1650-1700 F in hydrogen.

In terms of starting materials, the process can coat decarburized or titanium-stabilized hot-rolled coils or annealed cold-rolled coils. Chromium powder, mixtures of chromium and iron powders, or ferrochrome powders with varying chromium contents can be used. A very effective combination of material economy and product quality is obtained by using titanium-stabilized low-carbon sheet steel and a low-carbon ferrochrome powder containing 68-72 per cent chromium.

Carbon and nitrogen in the coating alloy not only detract from corrosion resistance but also reduce ductility. Therefore, titanium-stabilized low-carbon steel is preferred because all of the carbon

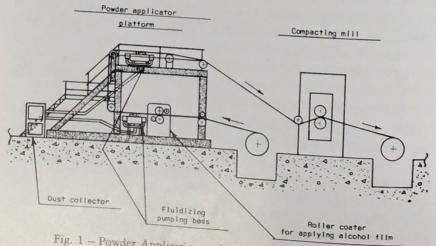


Fig. 1 - Powder Application and Roll Compacting Apparatus.

and nitrogen in the steel is combined with the titanium, thus preventing these elements from diffusing to the coating during the diffusion treatment. Similarly, low-carbon ferrochrome (0.05 per cent max C) is used to keep the carbon content of the coating as low as possible.

#### POWDER APPLICATION AND ROLL COMPACTING

A schematic diagram of the powder application and compacting mill is shown in Fig. 1. The coil stock is fed from the compacting mill pay-off reel into a roller coater which applies a very thin film of tridecyl alcohol to both surfaces. (Tridecyl alcohol is a nonflammable viscous fluid.) The strip is then passed over a specially designed fluidized bed containing the ferrochrome powder. Fig. 2 shows a schematic diagram of the fluidized bed. A steady stream of powder is lifted upward from the fluidized bed by rotating brushes. As it contacts the strip surface, a portion of the powder adheres to the alcohol film. A uniform layer of powder measuring 10 to 18g/ft² can be applied in this manner. The thickness of the alcohol film as well as the particle shape and size distribution control the amount of powder that adheres to strip.

The direction of the moving strip is reversed by passing over guide rolls so that the opposite side can be coated by a second fluidized bed. The strip is then passed through a single-stand twohigh rolling mill where the powder is roll-bonded to the surface.

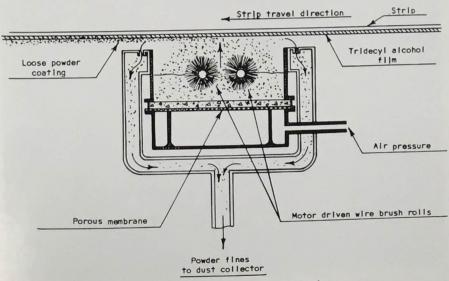


Fig. 2 - Fluidizing Pumping Bed.

Strip speeds of 200-400 ft/min are used in the powder application and roll-compacting operation. The roll pressure required to give satisfactory compacting causes the strip to elongate 1 to 2 per cent. The outer surface of the powder layer remains dry, i.e., free of alcohol during application and compacting. Thus, the compacting rolls remain dry and clean and there is no tendency for the powder particles to cling to them.

To achieve proper bonding, the steel base must be comparatively soft. Pickled hot-rolled strip can be coated satisfactorily without additional heat treatment, but cold-reduced strip must be annealed prior to compacting. Our present compacting and open coil annealing equipment is processing cold-rolled strip in gages from 14 to 26. If required, the equipment could be redesigned to handle heavier gages.

Bonding the powder on the strip surface prevents the powder from being removed by the open coil winding operation and by the circulating gases in the subsequent diffusion treatment. Compacting and bonding also provide the intimate contact necessary for the diffusion to occur.

Powder made up of angular particles gives the desired coating weight and also bonds well to the surface during roll compacting,

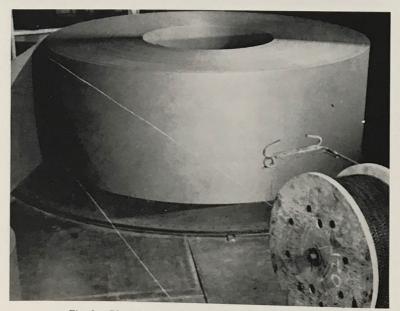


Fig. 3 - Photograph of Open-Coil Winding Operation.

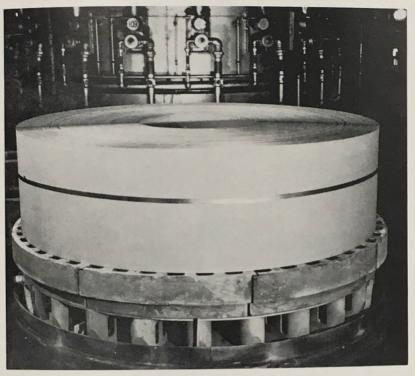


Fig. 4 – Photograph of Open-Wound Coil on Annealing Base After Diffusion Treatment.

whereas flat or flaky powders give coating weights that are too light and will not bond well.

#### **OPEN-COIL DIFFUSION TREATMENT**

The coil with its layer of compacted ferrochrome is now ready for the diffusion treatment. Temperatures of 1650-1700 degrees F are required to convert the layer into an iron-chromium alloy coating. Open coil heating is ideally suited for the diffusion treatment because welding of the coil laps is prevented and intimate contact is provided between the sheet surface and the atmosphere.

Following the powder-compacting operation the coil is open-wound using a kinked spacer wire positioned at both the top and bottom edge. Fig. 3 is a photograph of the open winding operation. The wire spacers are left in place during the diffusion treatment to maintain uniform spacing between the coil laps. After open winding, the coil is placed on a high-temperature open-coil annealing base for the diffusion treatment. Fig. 4 is a photograph of the open-wound coil as it appears on the annealing base after

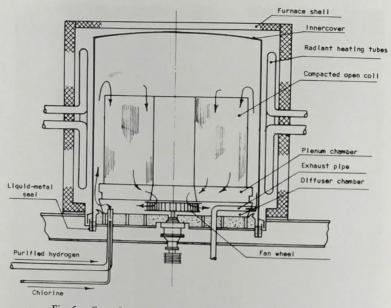


Fig. 5 - Cross-Section Diagram of Open Coil Annealing Base, Inner Cover, and Furnace.

the diffusion treatment is completed. A cross-section through the annealing base, inner cover, and furnace is shown in Fig. 5.

A high-speed fan draws the heated gases down through the openings between the laps of the open-wound coil to heat it. The gases, cooled by passage through the coil, are then forced through the diffusion chamber and upward along the hot inner cover walls where they are reheated. Hydrogen atmosphere is constantly fed into and exhausted from the chamber at about 900 cfh during the entire treatment cycle. A thermocouple inserted into the open coil at its coldest point during heat-up records and controls the steel temperature.

The diffusion cycle is outlined in Fig. 6. To form the desired coating by diffusion, the steel must be held at 1650-1700 degrees F for about 28 hours in a hydrogen atmosphere. To eliminate impurities, such as carbon, oxygen, and nitrogen that could combine with chromium in the coating and reduce corrosion resistance and ductility, the hydrogen is purified by passage through a palladium diffusion cell. In addition, a small amount of chlorine gas is added to the hydrogen during the initial portion of the cycle to help clean oxides from the compacted powder surface

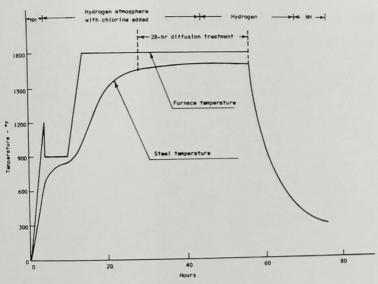


Fig. 6 - Typical Diffusion Treatment Cycle.

and to assist in maintaining non-oxidizing conditions.

At the start, dry NH gas containing 4 per cent hydrogen is used to flush air out of the retort and to maintain non-oxidizing conditions until the steel reaches about 800 degrees F. When the steel reaches 800 degrees F, the hydrogen-chlorine mixture is introduced. The steel is held for five hours at that temperature to flush out the NH gas, lower the dew point, and allow the vaporized tridecyl alcohol to be flushed from the system. After the five-hour hold, the coil is heated to 1650-1700 degrees F and held for 28 hours, the chlorine being eliminated after 16 hours of this period have elapsed. The furnace is then removed, and the coil is cooled in hydrogen to 500 degrees F. At this point NH gas is introduced, and when the steel reaches 300 degrees F the inner cover is removed. This completes the diffusion treatment.

The coil is now tight-wound for the usual sheet steel processing, including skin-rolling, slitting, and shearing. During tight winding the chromized surface is washed in a dilute nitric acid solution to remove traces of chlorides that had been deposited during the diffusion treatment.

#### FORMATION OF COATING BY DIFFUSION

Although the diffusion process is by its very nature a continuous one, to better understand how the iron-chromium alloy coating is formed it will be convenient to picture the process at selected periods during the diffusion treatment. The chromium distribution curves and schematics in Fig. 7 illustrate the effects of diffusion which progressively eliminates the original ferrochrome-steel interface to produce a diffusion-bonded alloy coating.

The initial period of the diffusion treatment, represented by Fig. 7A, is characterized by sintering of the compacted ferrochrome powder particles into a virtually continuous layer in which the chromium level remains at the original 70 per cent. However, some diffusion of chromium atoms into the steel surface also takes place, the chromium atoms being the solid black circles and the iron atoms being the open circles. The iron atoms scattered throughout the coating represent the 30 per cent iron contained in the ferrochrome powder. As interdiffusion progresses with chromium atoms pentrating into the steel and iron atoms into the coating layer, the ferrochrome-steel interface becomes less distinct, the overall chromium content of the coating alloy decreases, and the coating becomes thicker. For example,

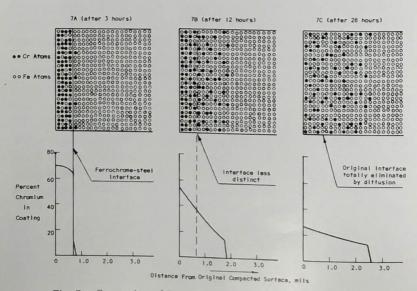


Fig. 7 - Conversion of Ferrochrome Layer Into Iron-Chromium Alloy Coating by Diffusion Treatment.

as shown in Fig. 7B, after 12 hours the chromium at the surface is reduced to about 55 per cent, the coating averages about 30 per cent chromium, and coating thickness has increased to 1.7 mils.

The coil is held at temperature until the chromium content at the coating surface is reduced to the optimum level for corrosion resistance, i.e., about 26-28 per cent. This chromium level is achieved in 28 hours when the preferred starting material is used, i.e., a ferrochrome powder containing about 70 per cent chromium applied at a weight of 15 g/ft. At the finish of the treatment, the original interface between the compacted layer and the steel surface has been completely eliminated by diffusion. At the surface the coating now contains about 28 per cent chromium, the chromium content decreasing to about 13 per cent in the vicinity of maximum penetration. The abrupt decrease in chromium content at the 13 per cent chromium level is explained on the basis of the difference in diffusion rates of chromium in austenite versus ferrite. At the diffusion annealing temperature of 1650-1700 degrees F the base steel is austenitic. However, the alloy coating is ferritic at chromium levels of 13 per cent and above. Chromium diffuses many times faster into ferrite than into austenite and thus tends to pile up at the point where the chromium is 13 per cent, a level which provides stainless properties.

The final coating represented by Fig. 7C is approximately 2.5 mils thick, as contrasted with the 0.7 mil thickness of the origi-

nal as-compacted layer.

Since the controlled diffusion treatment of an already present layer of compacted chromium on the open coil means full utilization of the available chromium, the thickness of coating that will be obtained at the end of the diffusion treatment can be precisely controlled by the amount of chromium originally applied as powder. This control includes allowance for the increased coating depth due to chromium diffusion into the steel, an effect which itself is dependent on the amount of chromium present and the treatment time.

Our brief outline of the progressive changes in the coating and in the steel surface during the diffusion treatment has served to point up the fact that diffusion is naturally suited to creating a coating with inherently excellent adherence. The original chromium-steel interface is completely eliminated by diffusion, with the result that the coating becomes integral with the steel base. Ductility, another requisite of a good coating, is provided by

judicious selection of materials.

The combination of excellent coating ductility and adherence together with the inherent formability of the low-carbon steel base gives a coated sheet that can be fabricated into a wide variety of end products by conventional forming and welding techniques. At the same time, the very fact that these properties guarantee coating integrity throughout fabrication makes Bethlehem's process suitable for the mass production of chromized sheet steel at the mill. As new markets develop for this versatile material, chromized sheet steel will be able to take its place alongside of sheet steels coated by the hot-dip and electrolytic methods.

#### Acknowledgment

The authors wish to thank the various members of the Sheet and Tin Mill Product Research Section of Bethlehem's Homer Research Laboratories who have made many important contributions to the development of the chromizing process described herein and B. S. Mikofsky for his assistance in the preparation of this manuscript.

#### BIOGRAPHICAL SKETCHES

EDWARD H. MAYER was born in Jefferson, Ohio. After three and one-half years of service with the U.S. Army Signal Corps he was discharged in 1946 with the rank of 1st Lieutenant. He graduated from Virginia Polytechnic Institute in 1950 with a B.S. in Metallurgical Engineering and joined Bethlehem Steel Corporation's 1950 Loop Course, Management Training Program for College Graduates, on August 14, 1950. He was assigned to the Research Department as an Engineer Assistant in the Physical Metallurgy Division, promoted to Engineer in 1951 and to Supervisor in 1961. In February 1964 he was promoted to Assistant Section Manager of the Metallurgical Coatings Section and a year later to Section Manager, Sheet and Tin Mill Products Section of Forming and Finishing Research, the position he holds at the present time.

RICHARD M. WILLISON was born in Carnegie, Pennsylvania. While attending college he worked two summers at Bethlehem Steel's Leetsdale Plant, and graduated from Carnegie Institute of Technology in 1958 with a B.S. in Metallurgical Engineering.

He joined the Bethlehem Steel Corporation's Loop Course, Management Training Program for College Graduates, that year. He was subsequently assigned to the Research Department as an Engineer Assistant in the Physical Metallurgy Division, advanced to the position of Engineer in 1959, and was promoted to the position of Supervisor, Process Development Group, Sheet and Tin Mill Products Section of Forming and Finishing Research in 1965. He attended Lehigh University Graduate School on a part-time basis since 1959 and was awarded his M.S. in Metallurgical Engineering in February 1965 from this institution.

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## Chromized Steel

... Corrosion Resistance at Less Cost Than Stainless Steel

... Welds Are Strong and Corrosion Resistant

Adapted and Reprinted from METAL PROGRESS January, 1967

BETHLEHEM STEEL





## Chromized Steel

Corrosion Resistance at Less Cost Than Stainless Steel

By RICHARD M. WILLISON and JULIUS v. D. FORSTMANN

Low carbon steel sheet with chromized surfaces resists corrosion and oxidation at moderate temperatures almost as well as type 430 stainless steel. Because it is also easily formed and comparatively inexpensive, it should be useful for mufflers and other components that must withstand acids and heat.

UNIQUE CHARACTERISTICS PLUS comparatively low cost make chromized sheet useful for corrosive and elevated temperature applications as muffler parts, tail pipes and heat reflectors. To date, in fact, it has been used in automotive exhaust systems, heat exchangers and furnace baffles. Chromized steel is coated with an iron-chromium layer which has a chromium content of 25% at the sur-

Mr. Willison is supervisor and Mr. Forstmann is engineer, Homer Research Laboratories, Bethlehem Steel Corp., Bethlehem, Pa.

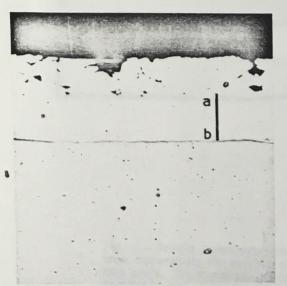


Fig. 1 — Microscopic roughness gives the surface of chromized steel a matte appearance. Depth of the coat, indicated by the line, ranges from 0.0015 to 0.0020 in. Etchant, 2% Nital, 300×. Line "a-b" defines the coating proper, which is the coating minus the porous surface layer.

face and about 13% at the diffusion bonded interface.

Typically 0.0015 to 0.002 in. thick, the coating is very ductile. The coated sheet has mechanical properties which are similar to those of drawing quality grades of cold rolled sheet steel. It can be formed and drawn by conventional processes and equipment without breaking the coat or causing failure of the base steel. Furthermore, the coating resists attack by alkalis and many acids, particularly those of automotive exhausts.

#### Features of the Material

Base for the chromized sheet is a low carbon grade (0.05% C max) stabilized with 0.30 to 0.40% Ti. (Typical composition: 0.04 C, 0.30 Mn, 0.008 P, 0.017 S, 0.018 Si and 0.36 Ti). The titanium unites with the carbon, forming stable titanium carbides; this forestalls diffusion of the carbon to the chromium-rich surface during the chromizing operation. To this sheet is diffusion bonded a layer of iron-chromium alloy that adds corrosion

Table I - Mechanical Properties of Sheet Steel

Steel	Yield Strength, Psi	Tensile Strength, Psi	Elongation, %	Hardness, Rockwell B	Olsen Cup Test, In
Chromized	27,300	46,500	35.5	48	0.404
Cold rolled, special killed, drawing quality Cold rolled, rimmed,	24,000	45,000	39.0	37	0.420
drawing quality	28,000	45,000	36.0	42	0.400
Aluminized, type 1	38,000	54,000	27.0	54	0.390
Type 409 muffler	48,000	68,000	29.0	72	0.350
Type 430	55,000	73,000	25.5	80	0.350

resistance similar to that of ferritic stainless steel. Illustrating a typical cross section, Fig. 1 reveals the microscopically rough surface that gives the sheet a matte finish.

#### Formability Is Good

A major advantage is that the sheet can be easily formed and shaped. Being ductile and diffusion bonded, the coating will not flake or spall during forming. Figure 2 shows stretched tensile specimens and cups, 2 in. in diameter (formed from 4 in. diameter blanks in a single draw). As with the fractured tensile specimen, one of the cups was immersed in hot nitric acid until the base steel was completely dissolved. Consequently the two "cups" shown at the right represent the coating on each surface. As is evident, drawing did not break the coating.

#### Strength and Ductility

Chromized sheet, as Table I shows, has mechanical properties comparable to those of other steels, especially cold rolled varieties. Being softer and more ductile, chromized steel is easier to form than aluminized and stainless steels. At the same time, it has excellent oxidation resistance to 1500 F and strength comparable with that of type 430 stainless between 1200 and 1500 F. Tensile strengths of both stainless and chromized sheet drop from about 18,000 to 8000 psi in this range which represents

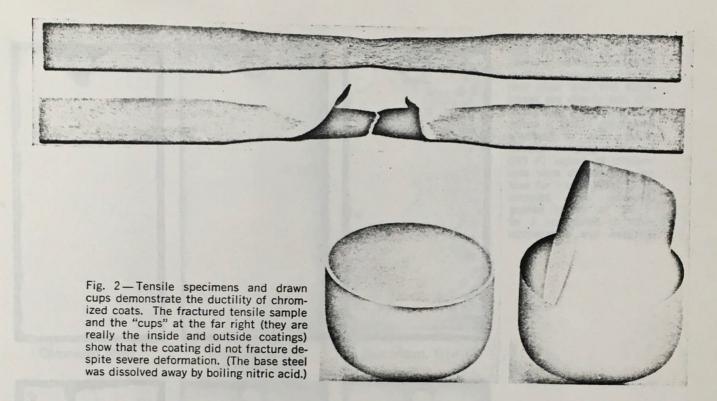
Table II - Corrosion Resistance of Chromized Sheet and Other Steels\*

Steel	H₂O at	Humidity,	Salt-	20%	7.5%	19%	20%	1.25 N
	≥ 200 F	100% at 100 F	Fog†	HNO <sub>3</sub>	HCI	H <sub>2</sub> SO <sub>4</sub>	Acetic Acid	NaOH
Chromized Cold rolled, rimmed Aluminized, type 1 Type 409 muffler Type 430	Good Poor Fair Good Very good	Very good ‡‡ Poor Good Good Very good	Fair‡‡ Poor Fair Fair Good	Very good Poor Very good Good Very good	Poor Poor Poor Poor	Poor Poor Poor Poor	Very good Fair Very good Good Very good	Very good Good Poor Good Very good

<sup>\*</sup>Various acid and NaOH solutions heated to 150 F. Concentrations given in volume per cent.

<sup>†</sup>Salt-fog test according to ASTM-B117-57T specifications.

ttPassivated in 20% HNO3 at 150 F for 30 sec.



the operating temperatures of many combustion chambers, heat exchangers and heat baffles.

#### Formability and Corrosion Resistance

The microscopic roughness of the surface does not interfere with forming operations, and die wear is not excessive. Its drawability is exemplified by the tank head on page 2-it was formed in one draw without special lubricants. The heat reflector shown is an example of the intricate shapes that can be formed. Note too that the tail pipe is resistance welded. As described by Messrs. Melloy and Brubaker in the article on page 8 chromized sheet can be welded conventionally.

Table II lists the effects of several corrosive environments on corrosion resistance. Note that exposure to water, acids, salts and high temperature oxidation prove that the coated sheet performs much like type 430 stainless steel, except in the salt-fog and humidity tests. Resistance of chrom-

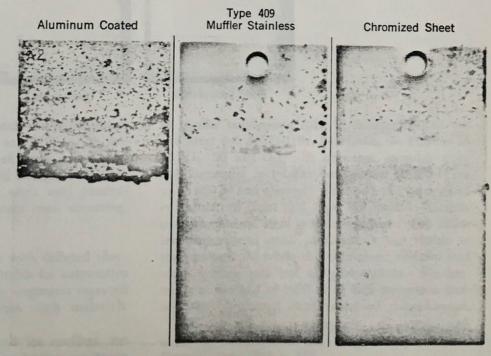
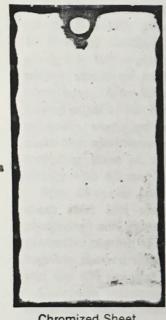
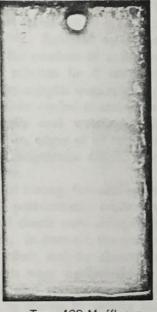


Fig. 3—Cleaned specimens show that muffler stainless and chromized steels resisted muffler condensate at 185 F better than did aluminized steel. The latter remained in the condensate only 650 hr while the others were held for 820 hr.



Chromized Sheet



Type 409 Muffler Stainless Steel



Aluminized, Type 1



Fig. 4 - After 13 cycles (days) of testing in artificial muffler condensate, chromized steel and two stainlesses are clearly less corroded than aluminized, cold

and

samples hanging in the hot (185 F) vapors of condensate were dipped once an hour for 7 sec. After 20 hr,

heated in air at 500 F for 2 hr. cooled to room temperature and weighed.

rolled

grades.

samples

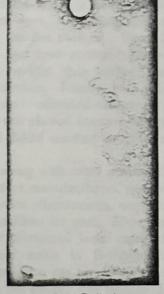
galvanized

In each cycle.

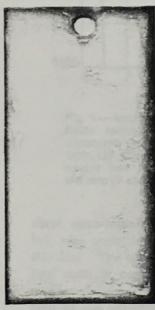
were removed.



Type 430 Stainless Steel



Cold Rolled



Galvanized Steel

ized sheet to salt-fog environments can be improved by passivating in 20% HNO3 at 150 F for 30 sec. In the humidity test, chromized sheet rusted to a light, superficial stain which did not affect its overall corrosion resistance. The nitric acid passivation described prevents this stain from occurring.

#### Potential for Mufflers

In service tests, sheet steels with diffused chromium coatings have proved suitable for automotive exhaust systems, and U.S. Army engineers reported that truck mufflers made from such materials served excellently.\*

Anticipating use of this sheet for mufflers, we have placed special emphasis on testing resistance to muffler condensate (pH, 2; composition in mg per liter: 590 HCl+HBr, 94 H<sub>2</sub>SO<sub>4</sub>, 34 H<sub>2</sub>SO<sub>3</sub>, 16 H<sub>2</sub>PO<sub>4</sub>, 20 H<sub>2</sub>CO<sub>3</sub>). In one test, samples were half-immersed in muffler condensate at 185 F for up to 820 hr and cleaned. In Fig. 3, the superiority of chromized sheet and type 409 muffler stainless over aluminized steel is quite evident. The stainless had several small perforations (not visible in the photograph) while the chromized samples had some surface pits but no perforations. Furthermore, at the end of 1000 hr of half-immersion testing, the chromized steel remained unperforated.

<sup>&</sup>quot;Chromium Impregnated Steel - a New Muffler Material", by Bernard Trock and George W. Myrick, Metal Progress, April 1964, p. 115.

The second test was by cyclic immersion at 185 F in synthetic muffler condensate (a solution of 100 ml of 1.0 N HBr plus 100 ml of 5.0 N H<sub>2</sub>SO<sub>4</sub> in 10 liters of distilled H<sub>2</sub>O). Samples were suspended in hot vapors of the condensate and completely immersed in the solution for 7 sec once every hour. After 20 hr, the samples were removed, heated in air at 500 F for 2 hr, cooled to room temperature, examined visually and weighed. To make test conditions uniform, edges of all samples, including those of the homogeneous alloys, were coated with silicone rubber.

After 13 cycles (days) of testing, the cold rolled sheet steel had several perforations, while the aluminized and galvanized sheets were stripped of protective coating (Fig. 4). In contrast, the muffler stainless showed little ill effect, and the chromized and the 430 stainless sheets were unaffected.

Corrosion resistance is also related to surface chromium concentration, as shown by weight loss data in Fig. 5. Thus, the chromized steel showed a smaller weight loss than type 409 muffler steel in the cyclic test. In fact, the loss rate for the stainless changed after seven days, suggesting that a compound was forming on the surface. Type 1 aluminized, the muffler and heat resistant grade, lost considerably more weight than either the chromized steel or the stainless. Finally, both galvanized and cold rolled steels corroded extensively; data for the latter were not plotted because heavy oxide layers formed and flaked causing weights to vary erratically.

Since these two tests, along with other simulated service tests used by muffler manufacturers, cannot be the final word on service effectiveness, we also tested chromized steel mufflers on cars. Here's a typical result: A muffler fabricated from some of the first chromized sheet made in Bethlehem's pilot operation was tested on a car for 19 months and 19,000 miles. When the muffler was sectioned, the chromized coating was found to be corrosion-free. As this sheet continues to be produced, we plan to study the results of correspondingly longer periods of performance.

#### Oxidation at High Temperatures

To use chromized sheet for applications such as furnace baffles, heat exchangers and combustion chambers, designers need data concerning its oxidation behavior in air at elevated temperatures. Samples of various materials were exposed to 1500 F up to 500 hr with a continuous supply of air flowing at 6 cu ft per hr through the furnace. The cold rolled steel gained weight rapidly, as did type 1 aluminized sheet.

Conversely, the rate of oxidation for chromized

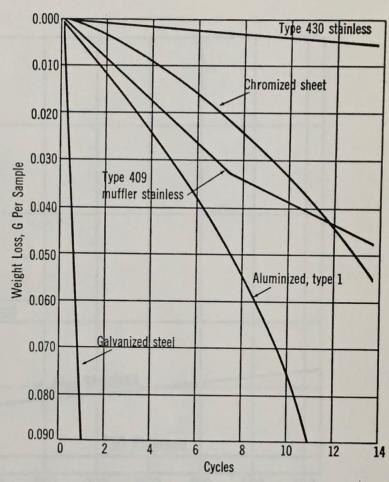
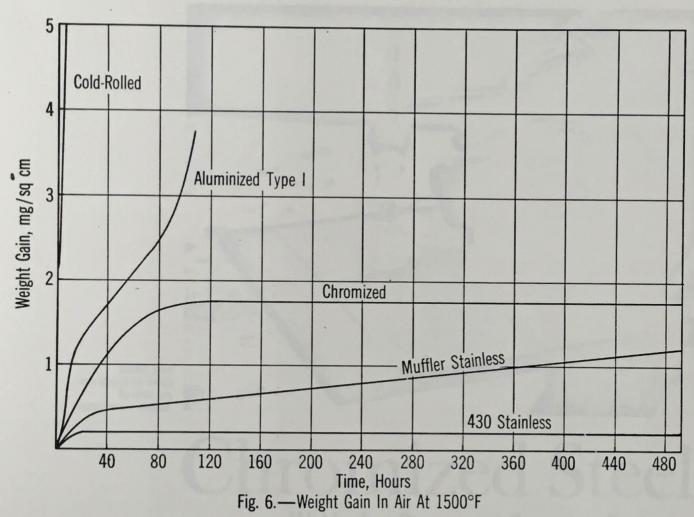
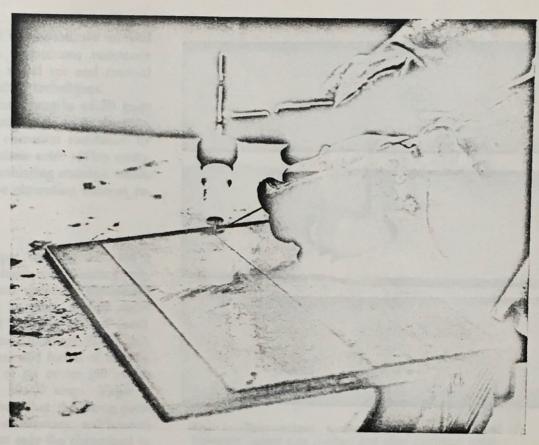


Fig. 5 — Weight lost during cyclic tests (Fig. 4) reflects corrosion resistance of steels. Note that chromized steel lost less weight than all grades but type 430 stainless steel. The change in rate of weight loss for the muffler grade indicates that the rate of corrosion attack changed during the test.

sheet, once initial oxidation occurred (in about 120 hr), was quite low, paralleling that of type 430 stainless. The higher initial weight gain of chromized steel in comparison with type 430 and 409 muffler stainless is due to the microscopic roughness of the chromized surface. This results in a larger actual surface area. The oxide layer that forms on chromized steel up to 1500 F is adherent and does not spall during cyclic heating and cooling. In short, behavior of chromized sheet up to 1500 F is similar to that of a ferritic-type stainless steel of comparable chromium content.

On the other hand, the weight-gain curve for muffler steel slopes slightly upward as shown in Fig. 6, indicating that oxidation continues. When removed from the furnace, type 409 muffler stainless had a powder-like scale which was easily brushed away. Obviously, instead of passivating, the material deteriorates continuously.





Welder joins two chromized sheets by inert gas, tungsten arc method.

## Chromized Steel

## ... Welds Are Strong and Corrosion Resistant

By GEORGE F. MELLOY and ENOS H. BRUBAKER

With simple modifications in conventional procedures,
welders can produce ductile, strong
corrosion resistant joints by resistance spot,
flash, continuous resistance seam,
automatic gas metal arc and manual gas
tungsten arc methods. For each technique,
Joint strength equals or betters that
of the metal joined, and corrosion resistance
equals that of the coating.

Chromized sheet can be applied where conventional corrosion resistant materials such as stainless steel cost too much. The welder must, of course, join the material to give the closure as much strength, ductility and corrosion resistance as the base sheet. Because corrosion resistance is limited to a thin surface layer, such joining becomes a problem. The main difficulty lies in maintaining the continuity and integrity of the corrosion resistant layer across the weld joint.

Since we were aware that practical, commonly

Mr. Melloy is section manager and Mr. Brubaker is engineer, Homer Research Laboratories, Bethlehem Steel Corp., Bethlehem, Pa.

available procedures would be needed, we worked with resistance spot, flash, continuous resistance seam, automatic inert gas, metal arc and manual inert gas, tungsten arc welding techniques.

We then determined joint strengths of 20 gage chromized sheet by standard tensile tests, ductility by simple bend tests and corrosion resistance by immersion in boiling 20% nitric acid. (This corrosive solution, popular for evaluating stainless steels, does not attack steels if the chromium content remains above about 12%.)

#### Resistance Spot Welding

To evaluate resistance spot welding we used a standard 250 kva single-phase spot welding machine to join (1) chromized sheet to chromized sheet, (2) chromized sheet to plain carbon sheet and (3) plain carbon sheet to plain carbon sheet. All sheets were of the same thickness (0.035 in.). We used electrode diameters and forces of 0.20 in. and 1150 lb, a weld time of six cycles (60 cycles per sec) and a current of 10,000 amp. Table I, which lists test results, shows that the three combinations of sheets had satisfactory mechanical properties after welding, but only the chromized to chromized combination passed the corrosion test.

Figure 1 illustrates specimens of welded chromized sheets after testing for nugget size and after the corrosion test. Note that around the spot weld corrosion resistance equals that of the chromized sheet, but the edges of the specimens were severely attacked. Therefore, it is best to protect (by overlapping) any edges which might be exposed to corrosion in service. Seam welding could also be used.

When determining electrode life data, we used AWS Class II electrodes along with the maximum welding current that could be applied without causing weld metal to spit during the spot welding cycle. After each 250 welds, a nugget was pulled and measured. In all instances, the electrode eventually began to upset or mushroom, with very little evidence of corrosive action at the tip. On the chromized to chromized combination, this life equaled or bettered that for the plain carbon to plain carbon combination. Over 8500 satisfactory spot welds were attained with both of these combinations, and 6500 welds, a satisfactory life, were attained with the chromized to plain carbon steel combination.

#### Flash Welding

To evaluate flash welding, we used a standard 50 kva machine. In initial trials, welded specimens of chromized sheet met tensile and ductility re-

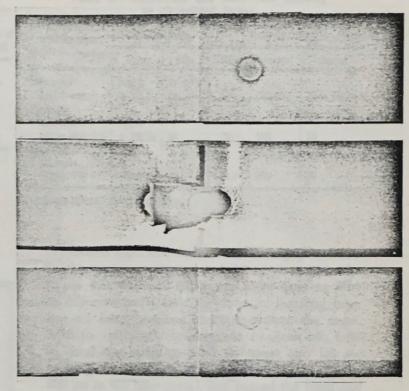


Fig. 1—Spot welded specimens (top) demonstrated adequate nugget size (center) and good corrosion resistance (bottom) in boiling nitric acid. Severe edge attack indicates that chromized steel components intended for corrosive service should be protected at edges by proper weld design or selection of welding procedure.

quirements satisfactorily. The tensile specimen, in fact, broke in the base metal well away from the joint. However, all specimens failed the corrosion test. To explain, with this welding method, the surfaces to be joined are butted together. When the welding cycle begins, the two pieces are slightly apart. Current arcs across the gap, burning off a preset amount of material from the edges. Then, the two edges are forced together, expelling metal from the joint. Thus, as Fig. 2 shows, the chromized surface is pushed up and separated, exposing base material.

When, after numerous efforts to avoid this condition by controlling the welding variables, it became obvious that exposure of this corrosion-prone zone was inherent to the process, we began to search for other ways to make satisfactory flash welds. One technique we developed is "alloy injection" method. It involves applying a source of high chromium into the butt before welding. Then, during welding, this source — a wire of stainless steel or ferrochrome powder — supplies chromium which forms a continuous layer with high chromium content across the weld zone.

Each weld specimen consisted of two strips of

Table I - Spot Welding Chromized Sheet

Steel	Diameter of Fused Zone, In.	Boiling 20% Nitric Acid Test	Breaking Load per Weld, Lb	Shear Strength o Weld, Psi	
Chromized to chromized	0.20	Pass	800	25,400	
Chromized to plain carbon	0.20	Fail	850	27.000	
Plain carbon to plain carbon	0.20	Fail	925	29,400	

Fig. 2—To assure continuity in the chromium coating on a flash weld, a source of added chromium is needed. On the top, flash welding exposed the base metal (2% Nital etch,  $100\times$ ); the weld on the bottom (4% Picral etch,  $40\times$ ) was made by the alloy injection method with ferrochrome powder.

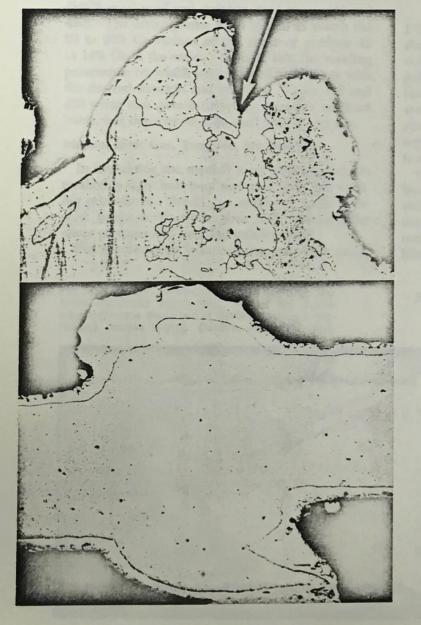


Table II — Automatic Gas Metal Arc Welding of Chromized Sheet

Welding Wire	Shieldi	ng Gas	Welding Variables					
(0.035 In. Diam.)	Туре	Flow	Voltage	Current*	Speed			
Mild steel, 0.07 C max	Argon + 2% 0 <sub>2</sub>	27 cu ft 2 per hr 17 v 150 a		150 amp	45 in. per min			
Type 430 stainless	Argon							
(14 to 18% Cr) Type 446 stainless	+ 1% 02	30	19	100	36			
(23 to 27% Cr)	Argon	40	18.5	100	35			

<sup>\*</sup>Direct current, reversed polarity.

chromized sheet laid end to end with a gap between. In this gap was aligned a 1/16 in. diameter wire (types 430, 446 and 310 wires were used as filler in different tests), held in place by masking tape. For all tests, welding conditions were the same: 5/16 in. initial die opening, ½ in. flash off, 5/32 in. final die opening, 1/32 in. upset and 1.6 sec flashing time. All welded specimens broke at 46,550 psi in the base metal, and passed the bend and boiling 20% nitric acid test for corrosion.

Figure 3 illustrates tensile specimens of chromized sheet which were tested for tensile strength and corrosion resistance. The alloy injection method provides a strong, sound weld which is as corrosion resistant as the coating.

We also devised a "profile edge" method for this purpose. The edges to be joined are etched in boiling 20% nitric acid which eats away the base metal, putting the chromized surface layers into relief — 45 sec in the acid puts the chromium layers 1/64 in. in relief; 90 sec, 1/32 in. and 180 sec, 1/16 in. We made satisfactory welds by using 1/32 in. relief, 5/16 in. initial die opening, ½ in. flash off, 5/32 in. final die opening, 1/32 in. upset, and a flashing time of 0.7 sec. Alloy injection and profile edge techniques can be used together to make good welds also.

#### Continuous Resistance Seam Welding

Though chromized sheet can be welded by this method — we used a 250 kva, 60 cycle, single-phase resistance seam welding machine — initial tests demonstrated that conventional procedures were not suitable since they disturbed the chromized coating. Fortunately, we were able to compensate for this by using the profile edge procedure to make strong, ductile weld joints which passed the boiling 20% nitric acid test. In seam welding, also, edges are mashed together by vertical forces.

In welding specimens of 20 gage sheet, we used the following: 850 lb electrode force; five cycles on time and two cycles off (60 cycles per sec); 1/16 in. overlap; 1/16 (or 1/8) in. profile; 30 in. per min welding speed. Samples broke in the base metal at 46,550 psi, and both welds passed the corrosion test.

Figure 4 shows typical cross sections. As with flash welding, alloy enrichment in the weld zone and combinations of alloy enrichment and profiled edges also produced satisfactory welds.

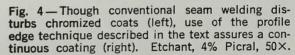
#### Automatic Inert Gas, Metal Arc Welding

During trials of inert gas, metal arc welding, we used a tight butt with a copper backing strip for the joint and two types of filler wire, a low carbon (0.07% max) steel and stainless steel (types 446 and 430). The latter grades were chosen to match the 20 to 30% Cr surface of the sheet or produce 12 to 14% Cr in the weld. Table II lists the welding parameters by which we produced weld joints with the desired strength and ductility. Types 446 and 430 wires also gave satisfactory corrosion resistant joints, but the wire of mild steel (0.07%) did not.

#### Manual Inert Gas, Tungsten Arc Welding

In evaluating the manual inert gas, tungsten are method, a tight butt joint was used with two welding procedures. Briefly, we employed a 2% thoriated tungsten electrode with and without filler wires of types 446 and 310 stainless steel.

For the two tests with stainless steel filler (wire,



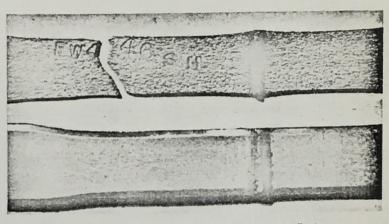
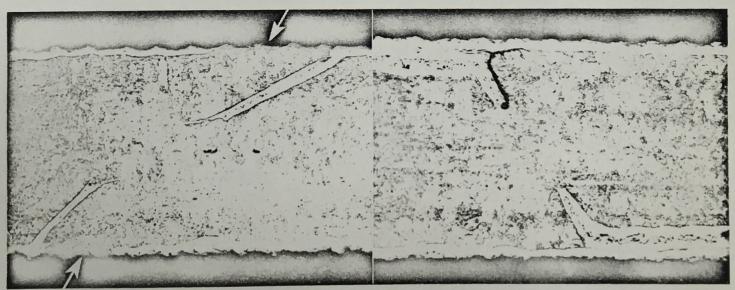


Fig. 3—The alloy injection method protects flash welds in chromized sheet from corrosion by boiling nitric acid (bottom). The weld is also stronger than the base metal as shown by the broken specimen.

1/16 in. in diameter), electrodes were 0.040 in. in diameter, and welds were made with an arc voltage of 12 v and 55 amp direct current, straight polarity. When no filler wire was employed, the electrode was larger (1/16 in. in diameter), and the weld was made with 60 amp (direct current, straight polarity) at 10 v. For all tests, argon flowing at 45 cu ft per hr protected the weld area from oxidation.

In all instances tensile specimens failed in the base metal well away from the weld joint and all welds had satisfactory ductility. Joints made without filler were low in chromium and failed the corrosion test, but joints made with stainless steel filler consistently passed.

Reprinted from Metal Progress, January, 1967





# Tried Chromized Steel Yet? Duo-Therm Has.

And boy, are they glad they did!

Duo-Therm Division of Motor Wheel Corporation produces the Duo-Therm line of compact gas-burning heating units specially designed for mobile homes and recreational vehicles.

The temperatures created in the combustion chambers (1,000-1,200°F) were above the temperature range of standard carbon steel sheets. Then along came Bethlehem's Chromized Steel, a cold-rolled carbon sheet with a diffused ferritic stainless coating. Chromized Steel's heat range easily met Duo-Therm's needs, and also made it possible for Chromized to replace a more expensive grade of steel for the baffles.

Chromized proved to be excellent in Duo-Therm's arc and spot-welding production operations.

Chromized steel's coating is uniform, continuous, ductile, and integral with the base steel. It will not crack under a 180-degree bend. We'll be glad to furnish technical help. Bethlehem Steel Corporation, Bethlehem, PA 18016.



Duo-Therm manufactures these heating units under the brand name of Duo-Therm Glen-Aire at a brand new plant in Sanger, California, making extensive use of Bethlehem's Chromized Steel sheets.

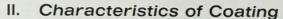




BETHLEHEM STEEL

# BETHLEHEM CHROMIZED SHEET STEEL

This is a new, corrosion-resistant sheet steel product especially suitable for such automotive exhaust system components as mufflers and tail pipes. Corrosion resistance is obtained by diffusing chromium into the surface of cold rolled sheet to form a stainless layer that cannot be mechanically stripped from the steel.



A. Finish: gray, matte

B. Thickness: .0015 to .002 inch

- C. Composition: Chromium content varies smoothly from about 25% at the surface to about 12% at the interface; balance substantially iron.
- D. Corrosion and High Temperature Oxidation Resistance: Generally similar to Type 430 stainless steel.
  - 1. Not attacked in boiling 20% HNO<sub>3</sub>.
  - 2. No perforation of sheet in half immersion test in actual muffler condensate at 185°F for 1000 hours.
  - 3. Resistance to chlorides relatively poor.
  - Excellent oxidation resistance up to 1500°F. Only an adherent, protective layer of scale formed when sample was held 250 hours in air at 1500°F.





#### III. Typical Mechanical Properties

	YIELD PSI	TENSILE PSI	UNIFORM ELONG.—%		HARDNESS R <sub>B</sub>	OLSEN INCHES
Chromized	27,300	46,500	20.5	35.5	48	.404
Cold Rolled, Rimmed Steel	28,000	45,000	22.0	36.0	42	.400
Cold Rolled, Special Killed Steel	24,000	45,000	25.0	39.0	37	.420



#### IV. Formability

- A. Capable of 180° flat bend without cracking coating.
- B. Has been formed into muffler parts, tail pipes, and various drawn parts without failure of the base steel or coating.

#### V. Weldability

Joints with good mechanical properties are made readily with any of the conventional sheet welding processes. Corrosion resistance at the joint is unimpaired with resistance spot welding. With the other welding processes, corrosion resistance across the joint can be maintained by using appropriate stainless steel filler metal or by special techniques for alloy enrichment of the weld area. Typical welding conditions for 20 gage sheet are shown in section VII.

#### VI. Size Range

- A. Gages: 14 to 26 inclusive.
- B. Coil widths: 2 to 41 inches in 14 to 26 gage inclusive.
- C. Sheet sizes:

WIDTH-INCHES	LENGTH	H-INCHES
41 max.	240 max.	30 min.
41 max.	240 max.	30 min.
41 max.	240 max.	30 min.
41 max.	240 max.	30 min.
41 max.	168 max.	19-1/2 min.
41 max.	168 max.	19-1/2 min.
41 max.	168 max.	19-1/2  min.
	41 max. 41 max. 41 max. 41 max. 41 max. 41 max.	41 max. 240 max. 41 max. 240 max. 41 max. 240 max. 41 max. 240 max. 41 max. 168 max. 41 max. 168 max.

#### VII. Typical Welding Conditions for 20 Gage Sheet

#### 1. Resistance spot

- a Electrode diameter . 20 inch
- b Electrode force-1150 lb.
- c. Weld time-6 cycles
- d. Welding current-10,000 amp.
- e. Tip life of standard Class II electrode—8500 welds with no change in nugget size.

#### 2. Metal inert gas

- a. Tight butt joint with copper backing strip.
- b. Type 430 stainless steel (14 18% chromium) .035-inch diameter welding wire. Type 310 stainless steel (24 26% Cr and 19 22% Ni) also has been successfully used.
- c. Shielding gas—argon + 1% oxygen at 30 cu. ft./hr.
- d. Arc voltage-19 volts
- e. Current-100 amps (D.C., reversed polarity)
- f. Speed-36 in./min.

#### 3. Manual tungsten inert gas

- a. Tight butt joint with steel backing strip.
- b. Type 430 stainless steel [14 18% chromium or 446 stainless steel (23 27% chromium)] 1/16-inch diameter wire filler metal. Type 310 stainless steel, as in 2b, can also be used.
- Welding electrode—2% thoriated tungsten, .040inch diameter.
- d. Shielding gas-argon at 45 cu. ft./hr.
- e. Arc voltage-12 volts
- f. Current-55 amp. (D.C., straight polarity)

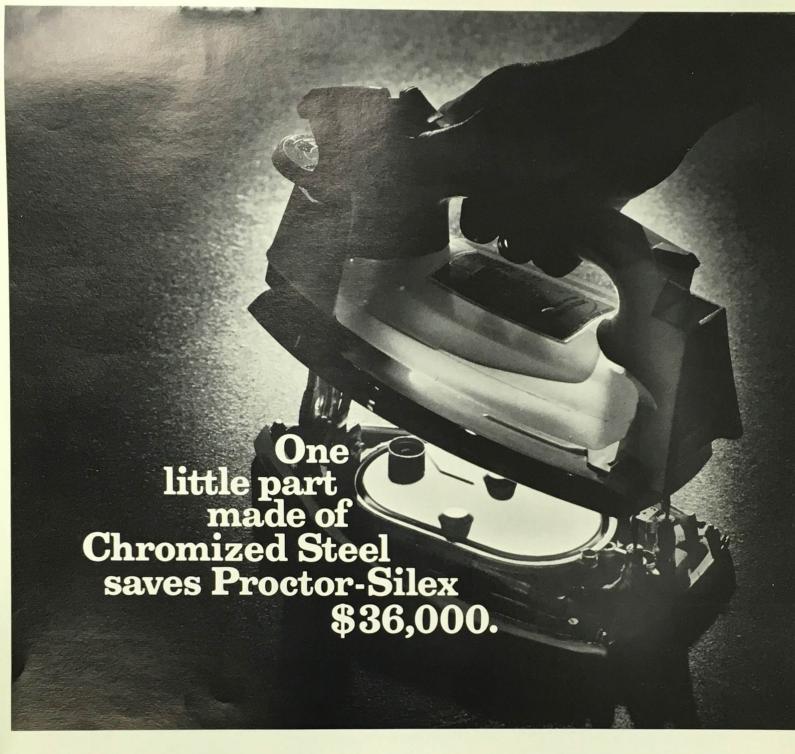
#### 4. Flash (Alloy Metal Injection)

- a. Standard Thompson 50 kva flash welding machine
- b. Type 430 stainless steel (14 18% chromium), 1/16-inch diameter wire filler metal.
- c. Initial die opening-5/16 inch
- d. Flash off-1/8 inch
- e. Final die opening-5/32 inch
- f. Upset-1/32 inch
- g. Flash time-2.0 seconds

Bethlehem Chromized Steel meets the Military Specification MIL-S-46055A (MR) 29 April 1966, (Amendment 1 of 10 May 1966 and Amendment 2 of 7 June 1966) for Sheet and Strip, Low Carbon, Chromized Steel.

### BETHLEHEM STEEL





That one little part—shaped like a race track—is the steam-chamber lid for a Proctor-Silex electric iron. Because of constant exposure to moisture and heat, it must be stoutly resistant to corrosion.

Proctor-Silex had been making this part of a relatively expensive material, and it did a good job. But when they tried Bethlehem's new Chromized Steel, it too did a fine job, at a much lower cost per pound. In fact, Chromized saved them \$36,000 in its first year! Chromized Steel is a special grade of cold-rolled sheet steel onto which a ferritic stainless coating has been diffused. The coating, which ranges from .0015 to .002 in. in thickness, is uniform, continuous, and ductile. Chromized can be welded and fabricated with standard equipment. Chromized Steel sheet is ideal for heat exchangers, burners, combustion chambers, and other items subjected to high-temperature oxidation. It may prove to be a money-saver for you. Try it.



#### BETHLEHEM STEEL

Bethlehem Steel Corporation, Bethlehem, PA 18016





## Savings of \$10,000 per month on material costs alone ... with **Chromized Steel**

Bryant Manufacturing Company, Indianapolis, produces heat exchangers for all of its products including all-weather heating and air conditioning equipment. Many parts must be made of specialized materials because of corrosion and temperature conditions encountered particularly in outdoor installations.

Recently, Bethlehem's Chromized Steel came to the attention of Bryant's production and technical

people. They tried it out, and found that Chromized had distinct drawing and welding advantages over the previous material, and superb corrosion resistance.

And now that it's in production, Chromized Steel is giving Bryant the best pay-off of all: a savings in materials costs of a solid \$10,000 per month!

Chromized Steel is a special grade of carbon steel sheet with a

diffused ferritic stainless coating which cannot be mechanically stripped. The sheet draws well and is readily welded. The coating will take the same deformation as the base steel. Chromized Steel may hold the answer to a metalworking problem of yours. We'll be glad to lend technical help. Bethlehem Steel Corporation, Bethlehem, PA 18016.

### BETHLEHEM STEEL

BETHLEHEM

Bryant has found that Chromized Steel has excellent formability and weldability.



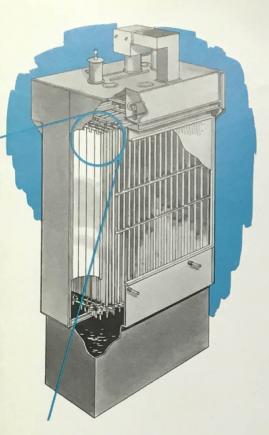




## dirt is beautiful

when it's electrostatically "glued" to Chromized precipitator plates





One of the tools we use to combat air pollution at our plants is the electrostatic precipitator, in which particles are electrostatically "stuck" to steel plates instead of going up the stack. And in the process of cleaning up our air we made an exciting discovery about one of our newer products—Chromized Steel sheet.

#### Problem: severe corrosion

Above is a simplified sketch of a precipitator which was installed at our Bethlehem plant years ago. It functioned well, but the highly acid particulate matter chewed the precipitator plates into junk within a year.



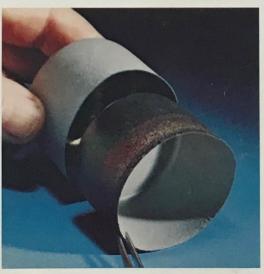
Believe it or not, this is what happened to the original precipitator plates in only one year!

#### **Enter Chromized Steel Sheet**

Bethlehem research engineers pointed out that our new Chromized Steel sheet should provide an answer to the problem. Chromized sheet is a ferritic-stainless-coated sheet which has tested out very favorably in comparison to certain stainless grades.

So we fabricated some precipitator plates from Chromized sheet and installed them in the unit four years ago. The color photo on the opposite page was snapped after random portions of the plates had been wiped clean. The Chromized plates look virtually as sound as the day we installed them, four years ago.

Sure, Chromized costs more than some steels, but it's far less expensive than others, and what a job it does! No special problems with forming, drawing, welding. Let's talk about it. Bethlehem Steel Corporation. Bethlehem. PA 18016.





#### Coating Integrity

These cups were drawn from a Chromized steel blank, with the base steel etched away in nitric acid until nothing remained but the coating. No breaks, no pinholes. That's coating ductility!

#### BETHLEHEM STEEL



### CHROMIZED STEEL FERRITIC-STAINLESS-COATED SHEET

Typical Mechanical Properties

Yield Strength, psi	Tensile Strength, psi	Total Elongation % in 2 in.	Uniform Elongation % in 2 in.	Hardness
22,000-32,000	40,000-50,000	30-37	18-22	R 45-60

Sheet Thicknesses — .0179 in. to .0747 in. (Standard cold-rolled tolerances apply.)

Widths-2 in. to 41 in.

Coating Thickness—2 mils, average.

Available in matte or new brushed finish as Commercial Quality only.

**Economical**—Easy to fabricate.

Applications — Chromized Steel can generally be used in all applications where 400-series stainless has been successfully used.

Typical uses are heat exchangers, oven fixtures, burners, etc., which take advantage of the high temperature resistance...up to 1,400 F continuously; up to 1,500 F in intermittent usage.

Other applications, such as mufflers, furnaces, electrostatic precipitators, silos, industrial roofing, benefit from the atmospheric corrosion resistance of the Chromized coating.



## CHROMIZED

matte finish



### CHROMIZED STEEL

brushed finish

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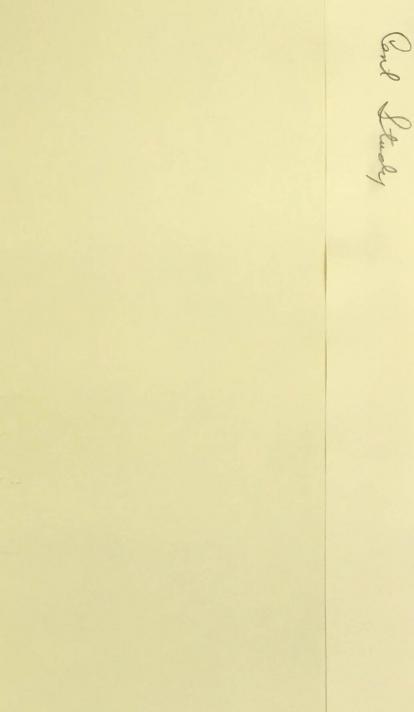
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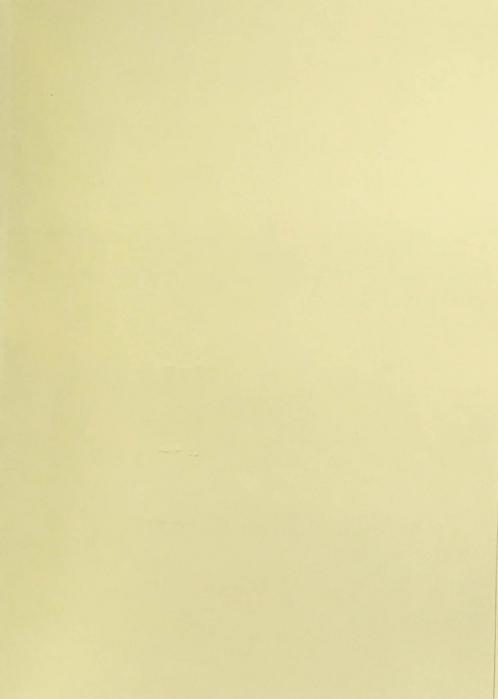
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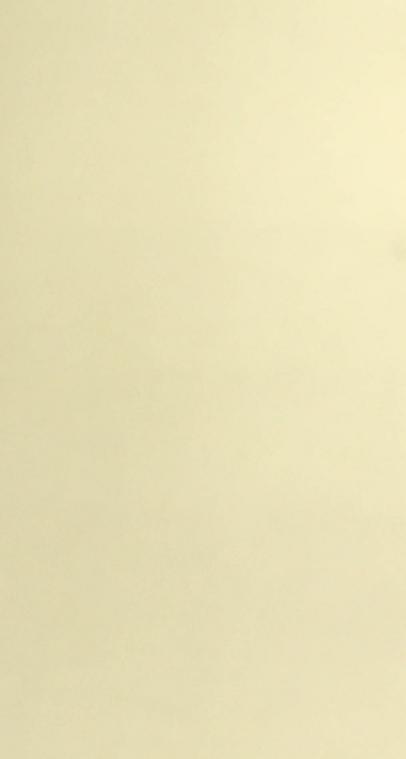


brushed finish





CFLETC Papet agreement



Mr. Rhea

Department of the Treasury

7-22-75

Office of Operations

For your information.

Assistant Director

John W. Mangels

room 1454 ext. 2916

### UNITED STATES OF AMERICA GENERAL SERVICES ADMINISTRATION WASHINGTON, DC 20405



July 16, 1975

Mr. Robert G. Efteland Acting Director, CFLETC Department of Treasury Washington, D.C. 20220

Dear Mr. Efteland:

Work on the Glynco master plan was started on June 30 under the authorization included in a unilateral contract amendment issued by this office directing Mrs. Smith to proceed with the work up to a cost of \$25,000. Mrs. Smith was advised that a final cost for the master planning process would be determined by negotiation after she had submitted a proposal covering all work involved and after GSA had prepared an audit report based on her proposal.

On July 15 her proposal, dated July 14, in the amount of \$296,548 was handcarried to this office. A copy of the scope of work involved in the proposal is attached for your information. The five stages in the scope have respective proposed costs of \$53,650, \$75,551, \$62,013, \$69,850 and \$36,484.

I have requested an audit of this proposal and hope to begin negotiations within 30 days. In the interim however, the \$25,000 authorization will be used up by the end of this week and work on the master planning process will stop. To preclude this I would like to amend this authorization and direct Mrs. Smith to proceed up to a total cost not to exceed \$200,000.

Your letter of July 9 indicates that no funds other than those previously authorized are to be obligated without your written approval. You are therefore requested to approve the use of an additional \$175,000 to further amend Mrs. Smith's contract so as to preclude complete curtailment of all planning for the permanent alterations at Glynco.

In the event that additional information is needed, I will be happy to provide whatever is required. Your early approval will be appreciated.

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Sincerely,

House & Breakley

HAROLD R. BUEHLER Acting Project Manager, Consolidated Federal Law Enforcement Training Center

Enclosures

CHLOETHIEL WOODARD SMITH & ASSOCIATED ARCHITECTS
1056 THOMAS JEFFERSON STREET, N.W., WASHINGTON, D. C. 20007 202-338-7440

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FFEDRIC A WIST
FICHARD L PASCHAL
CARL P KOHLIR
GINE RAY LEWIS
ATA

CABLE ADDRESS:TENFIVESIX

July 14, 1975

CWS 20 PM

Mr. Harold R. Buehler
Acting Project Manager
General Services Administration
19th and F Streets, N.W.
Room 6036
Washington, D.C. 20405

Re: CFLETC/Glynco

Dear Mr. Buehler:

Enclosed are my revised scope of work and fee proposals recognizing the changes we have discussed since my proposal dated June 20, 1975. I have prepared a separate, complete proposal for each stage of the work as you requested.

To permit the engineering consultant to start providing me with some much needed information, I hope you can authorize his immediate start given a limited initial expenditure such as the \$25,000 maximum presently imposed on me.

I am prepared to discuss this proposal at your earliest convenience.

Very truly yours,

Oblight Woodward Suith

Chloethiel Woodard Smith

cws/hgk encls.

CHLOETHIEL WOODARD SMITH FAIA
FFICHARD L PASCHAL
CARL R KOHLER
GENE RAY LEWIS
AIA

CABLE ADDRESS TENTIVESIX

July 14, 1975

PROPOSED SCOPE OF WORK BY
CHLOETHIEL WOODARD SMITH & ASSOCIATED ARCHITECTS
FOR THE MASTER PLANNING OF CFLETC/GLYNCO

#### STAGE 1. EVALUATION OF EXISTING FACILITIES

- A. Make an on-site survey of all existing structures deemed to have a reuse potential for the permanent center (approximately 50 items representing either a single building or a representative building of a repetitive group) as well as the site surrounding each building. Evaluation Forms will be completed for each structure and include an Initial Evaluation of each. The survey includes architectural, structural, plumbing, mechanical and electrical elements.
- b. Make an on-site survey of the entire area to be transferred to the Center, including all areas not evaluated above. Evaluation Forms will be completed and an Initial Evaluation prepared.
- c. Photograph all structures and site areas to illustrate existing conditions for reference in the development of Stage 2 of the work.
- d. Prepare a written report recommending which of the facilities surveyed are deemed appropriate for reuse and reasons for each selection. Also prepare a written report on all buildings deemed in poor condition for reuse and reasons why as well as recommendations for structures to be demolished.

Review by the Covernment and acceptance of the reports as submitted or modified after consultation with the Architect will provide the basis for Stage 2 studies.

e. Prepare a written report recommending changes in zoning of all properties surrounding the Center site. Obtain information on existing zoning of areas outside of those shown in the Glynco Development Plan. Present justification for all recommendations.

#### STAGE 2. PROGRAM ADAPTATION AND DESIGN STUDIES

- a. Prepare charts of the Beltsville program for structures to include not only square footage requirements and configurations of all functional areas, but ceiling heights, finishes, lighting, design standards, etc. and all special characteristics.
- b. Examine all existing structures designated as appropriate for reuse and prepare a series of charts to illustrate which structures can provide the same characteristics as the Beltsville program requires. Where similar sizes, shapes, ceiling heights, etc., cannot be provided, prepare a report as to what program revisions will be required to make use of existing structures. Preliminary sketch studies will be prepared in order to make these determinations so that comparative program charts can be presented for review and decision by the Government and a final program prepared.
- c. After analyses of feasible reuse for existing structures, determine what new additions or separate structures will be required to accommodate all functional areas which cannot be fitted into the existing structures. Prepare schematic

studies including net and gross areas required to meet the Beltsville program. Also prepare possible program revisions which might be considered if it appears that new additions and structures required to meet the Beltsville program cannot be provided within the budget. Submit reports for review and decisions by the Government.

- d. Prepare similar studies (a through c) and reports for all outdoor facilities required to meet the Beltsville program. Preliminary site studies will be prepared so that all comparative information is available for review and decisions by Government. Prepare final schematics (plans, sections and elevations) which meet all program requirements and show renovation and remodeling required for each facility and additions or new structures, including recommendations for plumbing, mechanical and electrical systems to meet the requirements of the revised program.
- e. Prepare a final coordinated program for the Center for final approval by the Government.
- #1 and #2 which describe work required to be carried out to meet the revised program. The sketches described in 2.d above plus these Forms completed for each facility and a record of original contract documents available will be presented so that they will provide a program package for one or more facilities which are to be made available for the A/E's who are to be interviewed for the development of final designs and contract documents.

#### STAGE 3. MASTER PLANS

a. Prepare a key map of entire Center property and surrounding area. (1:800)

- b. Prepare a plan of entire Center property showing (1) boundaries, grades, trees, structures, roads, drives, walks, etc., (2) sewers, drainage, water, steam distribution and any existing easements to be retained, and (3) telephone and electric service, including site lighting. (1:400)
  - Prepare preliminary studies which respond to the revised Program for 750 students and for future expansion to 1,500 students and prepare diagrams showing locations of all functions, relationships among these and circulation for review and approval by the Government. (1:400)
  - d. Prepare a Land Use Plan of the approved schemes developed above. (1:400)
  - e. Prepare a plan showing facilities to be demolished and proposed development of these sites. (1:400)
  - f. For the central development area, develop plans for (1) Site Development Plan for 750 student Center, (2) Utility Plan for 750, (3) Site Development Plan for expansion to 1,500, (4) Utility Plan for 1,500. (1:200).
  - g. Prepare rendered plans (including landscaping) for (1) 750 Student Center and (2) 1,500 Student Center. (1:200)
  - h. Prepare Site and Building Sections and Elevations for (1) 750 Student Center and (2) 1,500 Student Center. (1:40)
  - i. Prepare 8 detailed Sectional Site Development plans showing roads, drives, walks, parking areas, site lighting, landscaping, including all repair work, as well as new work required for the 750 Student Center. (1:40)
  - prepare a key plan showing new sectional division of site and structure and facility designations as a base map for use in information packages for A/E's to be interviewed and for staged construction. (1:400)

### STAGE 4. COMPARATIVE ANALYSIS AND INTEGRATION OF EXISTING AND REVISED SYSTEMS

Prepare studies of capital costs and operating costs for mechanical, electrical, sanitary and water systems. Cost comparisons will include alternative fuel and consideration of solar energy to augment other fuels. Fire protection systems will be analyzed to determine the degree of conformance with government life safety standards. Architectural consultation will be provided as required.

This study will include the integrating of existing and proposed mechanical, electrical, fire protection and sanitation systems with the Master Plan Construction Program.

#### STAGE 5. DESIGN REVIEW SERVICES

Review the architectural designs of individual buildings prepared by other A/E's to ensure adherence to the approved program, Master Plan and design guide. The reviews will be made at conventional review dates from Diagrammatics through completion of Contract Documents.

Scope assumes no more than five contract A/E's, that review meetings will be in Atlanta and that there will be 3 reviews per contract plus 3 visits to the construction site during construction.

Maximum time: 12 months.

#### SCHEDULE

Stage 1: 3 weeks
Stage 2: 7 weeks
Stage 3: 6 weeks

Total 16 weeks

Stage 4: 17 weeks (partially concurrent with Stages 2 & 3).

#### Professional Services

by

Chloethiel Woodard Smith & Associated Architects for STAGE 1, EVALUATION OF EXISTING FACILITIES

#### PERSONNEL - CWSAA

Ass Pro	incipal 148 Hrs. @ 17.25 soc. Architect 187 Hrs. @ 12.00 pject Architect 120 Hrs. @ 9.75 aftsman 45 Hrs. @ 7.50 Subtotals 495 Hrs.	= =	2,244	
	Overhead @ 1.45		9,145	
To	tal Salaries & Overhead			\$15,452
OTHER D	IRECT COSTS			
1.	Travel Washington to Brunswick 9 trips x \$170	=	\$ 1,530	
2	Car Rental 15 days x \$27	=	405	
3,6	Lodging & Meals 33 mandays x \$30	=	990	
4.	Reproduction			
	A. Photography B. Printing		300	
	(1) Base Material		100	
	(2) Report		250	
5.	Long Distance Telephone		75	
6.	Consultants: RWHDMK		15,524	
То	tal Other Direct Costs			\$19,174
TOTAL C	OST TO CWSAA			\$34,626 3,500

TOTAL COST TO GOVERNMENT OF STAGE 1

Consulting Engineering Services
by
Rosser White Hobbs Davidson McClellan Kelly, Inc.
for
STAGE 1, EVALUATION OF EXISTING FACILITIES

#### PERSONNEL - RWHDMK

	Seni Pro	ject Engine	Engineer eer,HVAC eer, Sanitar	80 100 100	Hrs. Hrs.	0 0 0	12.00	= = =	1,400 1,600 1,200 850 1,000 6,050			
		Overhead @	0.97						 5,869			
	Tota	al Salaries	& Overhead								\$11,91	9
THE	R DII	RECT COSTS										
	1.		Glynco Atlanta @ \$1 Savannah @ \$					==	\$ 300 135			
•	2.	Lodging & 12 mandays						=	420			
	3.	Long Dista	ance Telepho	ne					 50			
	Tota	al Other Di	rect Costs								905	5.
PROF		ST TO RWHDM	IK				2.03				\$12,820 2,700	
TATOT	COS	ST TO CWSAA	FOR STAGE	1				,		=	\$15,524	4

#### Professional Services

by

Chloethiel Woodard Smith & Associated Architects for

STAGE 2, PROGRAM ADAPTATION & DESIGN STUDIES

#### PERSONNEL - CWSAA

Principal 287 Hrs. @ 17.25 = \$ 4,950 Assoc. Architect 240 Hrs. @ 12.00 = 2,880 Project Architect 280 Hrs. @ 9.75 = 2,730 Designer 200 Hrs. @ 9.15 = 1,830 Draftsman 170 Hrs. @ 8.50 = 1,445 Draftsman 280 Hrs. @ 7.00 = 1,960 Draftsman 800 Hrs. @ 6.00 = 4,800 Subtotals 2,257 Hrs.	* 700 * 480 * 480 * 72,998
Overhead @ 1.45 . 29,864	
Total Salaries & Overhead	\$ 50,459
OTHER DIRECT COSTS	
1. Travel Washington to Brunswick 2 trips x \$170 = 340	
2. Car Rental 2 days x \$27 = 54	
3. Lodging & Meals 4 mandays x 30 = 120	
4. Reproduction	
A. Base Material B. Sepias for GSA  300 700	
5. Long Distance Telephone 100	
6. Consultants: RWHDMK 8,239	
Total Other Direct Costs	9,853
TOTAL COST TO CWSAA PROFIT	\$ 60,312
TOTAL COST TO GOVERNMENT OF STAGE 2	\$ 67,312

8,239

Consulting Engineering Services
by
Rosser White Hobbs Davidson McClellan Kelly, Inc.
for
STAGE 2, PROGRAM ADAPTATION & DESIGN STUDIES

#### PERSONNEL - RWHDMK

TOTAL COST TO CWSAA FOR STAGE 2

Principal Engineer 40 Hrs. @ \$17.50 = \$ 700 Senior Project Engineer 56 Hrs. @ 16.00 = 898 Project Engineer, HVAC 40 Hrs. @ 12.00 = 480 Project Engineer, Sanitary 40 Hrs. @ 8.50 = 340 Project Engineer, Civil 40 Hrs. @ 12.25 = 490 Subtotals 216 Hrs.	
Overhead @ 0.97	
Total Salaries & Overhead .	\$ 5,729
OTHER DIRECT COSTS	
1. Travel to Washington	
8 trips @ \$160 = \$1,280	
2. Lodging & Meals	
8 mandays $\times$ \$35 = 280	
3. Long Distance Telephone 50	
	1,610
Total Other Direct Costs	
TOTAL COST TO RWHDMK PROFIT	\$ <b>7,</b> 339

# Professional Services by Chloethiel Woodard Smith & Associated Architects for STAGE 3, MASTER PLANS

PERSONNEL - CWSAA	: : :		
Principal 200 Hrs. @ 17.25 Assoc. Architect 210 Hrs. @ 12.00 Project Architect 240 Hrs. @ 9.75 Designer 240 Hrs. @ 9.15 Draftsman 240 Hrs. @ 8.50 Draftsman 480 Hrs. @ 7.00 Draftsman 240 Hrs. @ 6.00 Subtotals 1,850 Hrs.		2,520 2,340 2,196 2,040	
Overhead @ 1.45		25,151	
Total Salaries & Overhead			\$42,497
OTHER DIRECT COSTS			100
1. Travel Washington to Brunswick 2 trips @ \$170	=	\$ 340	
2. Car Rental 2 days @ \$27	=	54	
3. Lodging & Meals 4 mandays @ \$30	=	120	
4. Reproduction		540	
5. Long Distance Telephone		100	
6. Shipping		50	
7. Consultants: RWHDMK		6,156	
Total Other Direct Costs			7,360
TOTAL COST TO CWSAA PROFIT			\$49,857
LUCITI			

TOTAL COST TO GOVERNMENT OF STAGE 3

# Consulting Engineering Services by Rosser White Hobbs Davidson McClellan Kelly, Inc. for STAGE 3, MASTER PLANS

#### PERSONNEL - RWHDMK

Principal Engineer 24 Hrs. @ \$17. Senior Project Engineer 48 Hrs. @ 16. Project Engineer, HVAC 40 Hrs. @ 12. Project Engineer, Sanitary 40 Hrs. @ 8. Project Engineer, Civil 40 Hrs. @ 12. Subtotals 192 Hrs.	00 = 00 = 50 = 25 =		
Overhead @ 0.97	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2,423	
Total Salaries & Overhead			\$ 4,921
OTHER DIRECT COSTS			
1. Travel to Glynco 1 from Atlanta @ \$100 3 from Savannah @ \$15	= \$ =	100 45	
<pre>2. Lodging &amp; Meals 4 mandays x \$35</pre>	<b>=</b>	140	
3. Long Distance Telephone		50	
Total Other Direct Costs			335
TOTAL COST TO RWHDMK PROFIT			\$ 5,256
MOMAT COCH MO CHSAA FOR STAGE 3	,		\$ 6.156

#### Professional Services

by

Chloethiel Woodard Smith & Associated Architects for

STAGE 4, COMPARATIVE ANALYSIS & INTEGRATION OF EXISTING and REVISED SYSTEMS

#### PERSONNEL - RWHDMK

	Principal Engineer		240	Hrs.	9	17.50	=	\$	4,2	200
- 1	Senior Project Engineer			Hrs.	9	16.00	=		5,3	120
	Project Engineer,	HVAC	800	Hrs.	9	12.00	=		9,6	500
	Project Engineer,									
	Fire Protection		240	Hrs.	9	14.25	=		3,4	120
	Project Engineer,	Plumbing	240	Hrs.	9	8.50	=		2,0	040
	Project Engineer,	Civil	240	Hrs.	a	12.25	=		2,5	940
	Drafting					5.70			A STATE OF THE PARTY OF THE PAR	850
	Subtotals	2	,580	Hrs.			•	\$3	10,1	170

Total Salaries & Overhead

Overhead @ 0.97

\$59,435

29,265

#### OTHER DIRECT COSTS

1.	Travel	to Glynco		
•	6 from	to Glynco Atlanta @ \$100	=	600
		Savannah @ \$15	=	90

2. Travel to Washington from
 Atlanta/Savannah
 9 trips @ \$160 = 1,440

3. Lodging & Meals 21 mandays @ \$35 = 735

4. Long Distance Telephone 150

5. Reproduction 400

Total Other Direct Costs

Total Other bires

TOTAL COST TO CWSAA PROFIT

TOTAL COST TO GOVERNMENT FOR STAGE 4

\$ 3,415

\$62,850

\$69,850

## Professional Services by Chloethiel Woodard Smith & Associated Architects for STAGE 5, ARCHITECTURAL DESIGN REVIEWS

PERSONNEL	- CWSAA
-----------	---------

	the state of the s				
Prin Asso	dcipal 432 Hrs. @ 17.25 cc. Architect 288 Hrs. @ 12.00 Subtotals 720 Hrs.	= 1		7,452 3,456 10,908	
	Overhead @ 1.45		-	15,816	
Tota	al Salaries & Overhead				\$26,724
OTHER DI	RECT COSTS				
1.	Travel To Atlanta \$150/RT x 22 trips To Glynco \$170/RT x 4 trips	= =	\$	3,300	
2.	Lodging & Meals \$40/day x 52 mandays	=		2,080	
3.	Long Distance Telephone			600	
4.	Shipping			100	
	al Other Direct Costs				6,760
	ST TO CWSAA				\$ 33,484
TOWNE CO	ST TO GOVERNMENT FOR STAGE 5				\$ 36,484

GENERAL SERVICES ADMINISTRATION OFFICE OF THE ADMINISTRATOR WASHINGTON, D.C.

DEPARTMENT OF THE TREASURY on OFFICE OF THE WASHINGTON, D.C. Sume 4, 1975

#### GENERAL SERVICES ADMINISTRATION

#### MEMORANDUM OF AGRIEMENT

ON

#### CONSOLIDATED FEDERAL LAW ENFORCEMENT TRAINING CENTER

#### BRUNSWICK, GEORGIA

#### PURPOSE AND INTENT

The Treasury Department is proposing to establish the Consolidated Federal Law Enforcement Training Center (CFLETC) at the former Glynco Naval Air Station, Brunswick, Georgia. The General Services Administration (GSA) will provide certain services to assist the Treasury Department in this effort.

This Memorandum of Understanding establishes:

- A. The policies which shall govern the relationship between the respective agencies during the life of this project,
- B. The functions, responsibilities and authorities of each agency,
- C. The objectives to be met in establishing the CFLETC.

#### POLICY

Location?

A. The GSA shall appoint a Project Manager who shall have overall management authority and responsibility for this project in so far as GSA shall have authority and responsibility for the project. The Project Manager's authorities and responsibilities are as delineated in the attached Charter for the Consolidated Federal Law Enforcement Training Center dated

- who shall have authority to act for the Treasury Department in all activities generated by this project. In the event actions or decisions are required which are beyond the scope of the authority of the Central Executive, he shall have direct and timely access to appropriate authorities within the Treasury Department who can take the necessary actions.
  - Requirements specifying what is to be accomplished at Brunswick.

    This Program Shall include all data required by GSA to accomplish site acquisition, design, construction and management of the project through and including completion of occupancy of the finished facility by the Treasury Department. It shall encompass requirements for site acquisition, and temporary as well as permanent facilities including such items as number and identification of buildings to be renovated, extended, or constructed, number of class rooms, dormitory spaces, administrative areas and other information similar to that contained in the Guidance Document for the CFLETC, Beltsville, Maryland. The level of renovation to be undertaken shall be determined by Treasury with necessary technical assistance from GSA.
  - D. GSA shall manage and administer the procurement effort specified in the above Program of Requirements and shall keep the Treasury

Department fully and currently informed on the status of and current plans for the project by means of periodic reports. GSA will operate under the policies, procedures, data, standards, specifications, criteria and financial accounting of the GSA, as a general rule. The exceptions will be the minimum essential to satisfy the substantive needs of the Treasury Department.

# FUNCTIONS, RESPONSIBILITIES AND AUTHORITIES, GSA

- A. GSA has prepared and issued a Charter establishing the Project
  Manager and his management office, defining his mission,
  responsibility, authority and major functions, and describing
  his relationships with other organizations, associated with or
  participating in the project.
- B. GSA will prepare a Project Master Plan which places in context the plans, schedules, costs and scope of all work and resources required for completion of the project. It will define the management approach for acquiring a project intended to satisfy the needs of the Treasury Department for a training center. The plan will be jointly approved by the GSA and Treasury by persons authorized to approve such plans.
- c. The GSA Project Manager shall be responsible for the successful accomplishment of the CFLETC project. He shall exercise executive authority over the planning, directing, and controlling of the

4.

approved and over the allocating and utilizing of all resources approved and authorized by Treasury for the execution of the project. Participating organizations will look to the GSA Project Manager as being responsible for determining how the actions of all organizations shall fit together. Specifically, the GSA Project Manager shall:

- (1) Translate the Treasury requirements into a program of work, in quantitative and qualitative terms, to accomplish the objective;
- (2) Define all management and technical functions and establish their boundaries;
- (3) Ensure that systems and procedures for carrying out the project are properly applied throughout the project;
- (4) Serve as the primary point of contact for communication and liaison with the Treasury in obtaining requirements and policy guidance to ensure expeditious accomplishment of the project;
- (5) Be responsible for preparing, securing approval of, and maintaining the project master plan;
- (6) Have authority to make technical and business
  management decisions required by the approved project;
- (7) Execute all contractual actions required by the approved project;

- (8) Determine the scope and schedule of the project

  effort to be accomplished by GSA and the costs

  of such effort to be defrayed by project funds;
- (9) Reschedule programmed events or actions, as required to compensate for unscheduled delays, to offset potential delays, or to improve the original schedule;
- (10) Reapply funds available to the project to promote more timely achievement of project objectives, provided that: the reapplication is within the overall limitations shown on the attached GSA Form\_\_\_\_\_\_;
- (11) Effect trades between approved performance

  parameters. Trades may be effected between

  performance or other factors that are not expected

  to cause any factor to fall outside minimum or

  maximum limits established by Treasury;
  - (12) Provide reports, as required by Treasury on the project, including periodic status reports, and provide immediate notification of actual or potential problems adversely affecting approved cost/schedule/performance limitations;
    - (13) Coordinate with local planning bodies and appropriate

      agencies having regulatory jurisdiction to ensure that

      necessary applications are submitted and approvals

      obtained in good time to meet the project schedule;

- (14) Arrange as part of the Project Master Plan for the development of a plan of action for acquiring project financing;
- (15) Develop the detailed design, including: site and equipment layouts, and preparation of major equipment and material specifications with data sheets, requisitions, and bid documents where required for the purchase of long delivery materials and equipment;
- (16) Schedule and coordinate the preparation of detailed design calculations, specifications, construction drawings, and material lists;
- (17) Supervise and coordinate the preparation of material requisitions and bid documentation for:

General Condition Items;
General site preparation;
Utility services;

Roads, earthworks, foundations, buildings, structures, drainage, and sanitary systems;

Power distribution and lighting;
Building drawings and specifications.

- (18) Prepare a complete package of bidding documents,

  advertise for bids and award all contracts required

  by the objectives of this project;
- (19) Pre-purchase any equipment items which may require

commencement of detailed design of the surrounding structures and services so that vendors' drawings are available for incorporation in the construction drawings;

(20) Establish a system of inspection and expediting to ensure delivery on schedule of prepurchased items;(21) Enter into a contract with a Construction Manager to carry out port ons of the project.

The Construction Manager will be responsible to the GSA Project Manager for coordination, general direction, and inspection of all construction and installation work on the site, including control over and measurement of quantities. Reporting to the Construction Manager may be construction supervisors, field engineers, surveyors, inspectors, and other technical personnel who will be responsible for monitoring and inspecting the work.

The Construction Manager shall assume responsibility for overall site security and safety, the establishment of site regulations, and maintenance of storage and warehouse facilities.

(22) Carry out or arrange for inspection at the vendors'

place of manufacture, in the contractors' shops, and on
the site to ensure conformity with specifications and
drawings; review vendors' and contractors' drawings to

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- ensure compatibility with other equipment and
  compliance with the contract documents;
- (23) Where required, obtain physical test certificates, witness performance tests, and other tests and reviews carried out to ensure that material and equipment meets quality and performance requirements.
- (24) Certify completion of the various stages of construction. Commissioning and start-up follows completion of construction and a pre-commissioning phase which involves preparing equipment for operation and the commencement of training programs for operating staffs and the continued property management activities;
- (25) Arrange for commissioning and start-up activities including:
  - (a) having equipment suppliers and contractors put into operation individual equipment items and system circuits and witness performance tests;
  - (b) placement of all equipment in readiness for operation and, in conjunction with the operating staff, bringing each system in sequence into full satisfactory operation;

- (c) inspection of applicable installations and equipment at the end of the warranty period;
- (d) establishment of move-in schedules and
  - provision of relocation assistance to Treasury;
- D. The General Services to be performed by the GSA during all appropriate phases of the project include, but are not limited to the following:

#### (1) Budget and Cost Controls

The GSA Project Manager shall undertake to utilize professional business management methods which have been developed and proved over a wide range of projects. Following the Conceptual Design and Planning Phase, the GSA Project Manager will:

- (a) Re-examine and revise the preliminary project estimates and schedules;
- (b) Establish a definitive budget for cost control purposes;
- (c) Prescribe a system of reporting on and controlling expenditures; and
- (d) Prepare cash requirement projections.

# (2) Project Accounting

The GSA Project Manager will establish project accounting

procedures and costs controls, which will be subject to audit, to cover all phases of the project, including:

- (a) Management; a' Overhead
- (b) Planning and design;
- (c) Disbursements;
- (d) Purchases;
- (e) Construction costs;
- (f) Inspection costs; and
- (g) Commissioning costs.

#### (3) Scheduling

Upon completion of Conceptual Design and Planning, the GSA Project Manager will establish a detailed project schedule for close control of all subsequent project activities. Key schedule dates will be 1 established. The GSA Project Manager will issue regular reports showing uprogress relative to the schedule. The schedule will incorporate all interrelated and interlocking activities such as:

- (a) Design;
- (b) Procurement and delivery of material and equipment;
- (c) Construction;
- (d) Inspection; and
- (e) Commissioning.

# (4) Reporting

The GSA Project Manager will report on a regular basis to the Treasury to keep it fully informed on all aspects of the project.

Reports will include:

ices,

- (a) Expenditures against budget and estimated cost at completion;
- (b) Progress compared against schedule in terms

  of work completed and work yet to be completed;
- (c) Required modifications to schedule and budget;
  and
- (d) Design changes.

#### (5) Project Organization

The GSA Project Manager will set up a project organization which is specifically structured to the size, complexity, and scope of the project. The composition of the organization will vary througe each of the project phases but normally will include staff to undertake overall management and management of Design, Accounting, Scheduling, Construction, and Commissioning. The GSA Project Manager will set up the administrative procedures and establish the time schedule in which the project is to be carried out. This will include:

- (a) Preparation of a general concept terminating in a report for approval by the Treasury;
  - (b) Preparation of general specifications arising out of the approved concept;
  - (c) Setting out project assignments, responsibilities,
    and coordination of procedures in respect to
    administration, accounting, purchasing, approvals,
    reports, and their distribution;
- (d) Establishing a code of accounts for design services,

equipment items, construction materials and
services; and

(e) Establishing a preliminary budget to define design costs, equipment and material costs, construction costs, and disbursements.

#### (6) Consultation

Significant project action, contractural or otherwise, will not be taken by the Project Manager, if such action may reasonably be foreseen to affect the Treasury project without full consultation and coordination with Treasury while the matter is still in the planning stage. The consultation and coordination will be accomplished with the full participation of the Treasury representative.

### FUNCTIONS, RESPONSIBILITIES AND AUTHORITIES, TREASURY

attributable to this project;

The Treasury Department will transfer necessary funds to GSA and provide requirements, information, and timely decisions as required for successful completion of the project. Specifically the Treasury Department will:

(1) reimburse GSA for all Project direct and indirect costs,

including GSA overhead and program direction costs as

provide a program of requirements covering the entire project which will include:

- (a) the scope of temporary alterations to be undertaken to provide for interim occupancy of the facility.
- (b) the scope of the alterations, extensions, and new

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construction to be provided for permanent occupancy.

This will include the number and location of buildings

to be renovated, extended, or constructed and the general

level of renovations to be undertaken;

- (c) general criteria required for development of a Master

  Site Plan including site limit delineations, landscaping,

  security fencing and demolition required;
- (d) the construction or renovation priorities of each structure or facility.
- drawings and approve or otherwise comment on the design documents during the on-board review. Final approval of all design shall be under the jurisdition of the Treasury

  Department, but such approval (or disapproval or comment) shall not be delayed so as to materially hold up the design process.

  No two on-hoard reviews shall be scheduled by GSA on the same day if at all possible to do otherwise.
- (4) Assist in the development and updating of the Project Master Plan by providing information available only to Treasury such as, desired sequencing of occupation of the completed facility, times for development of requirements and other information to be provided by Treasury necessary for design, construction and occupancy of the facility.

GSA will ovoperate with Trusay

- (5) Cooperate with GSA in the event any ground-breaking, ribboncutting or similar site ceremonies are to be held.
- of permanent alterations has been determined, especially bearing in mind that such changes during the construction period tend to cost far more than the actual value of the change as well as to delay the progress of the work.

As soon as the Project Master Plan is approved by Treasury and GSA, make available to GSA necessary funding as required by the Plan. Pending approval of the Plan, Treasury will make funds available at the request of the Project Manager accompanied by a written statement explaining and justifying the funding request. To the maximum extent possible funds shall be made available in the fewest possible authorization actions.

- (8) It is critical to the successfull completion of the project that all actions by all parties involved be taken at the earliest possible time. To this end provide information, decisions, and other assistance as required in a timely manner.
- (9) Provide the Project Manager with copies of all correspondence relating to this project which would not otherwise be available to him.
- (10) Act as the lead agency in the preparation of an Environmental

  Impact Statement or, if it so determines, in the preparation of
  a statement to the effect that the project will have no significant
  environmental effects.

- (11) Keep the Project Manager informed of all agreements between the Treasury Department and other parties which may have an effect on the project.
- (12) Provide support and assistance to GSA as required for the expeditious completion of the project. This will include providing temporary office and storage space at the site, if available, for GSA personnel, A/E personnel and contractors. Such space will be used until completion of all construction. Treasury will also provide the use of all available utilities including telephones, sewer, water, heating, and airconditioning both for the buildings being renovated, extended, or constructed and for the temporary office space.
- (13) Treasury will assist GSA as necessary in all meetings, presentation ceremonies, etc., with Federal, State and Local officials and organizations as required.

# **OBJECTIVES**

A. Description of project

The project for establishment of the Consolidated Federal Law

Enforcement Training Center at Brunswick will consist of renovation,
extension and construction of approximately 30 structures on a

1650 area segment of the former naval air station at Brunswick,
Georgia. It will provide space for administration, instruction,
physical training, housing, dining and maintenance for training
federal law enforcement officers from approximately 24 Federal
agencies. The majority of the structures are existing and will be

renovated and/or extended. Only one new building is involved. The project also includes alterations to several structures to provide space for interim occupancy by the CFLETC. The total estimated project cost including \$2,000,000 for interim occupancy alterations, is \$30,125,000.

#### Schedule В.

All activities are dependent on receipt of authorization to use funds appropriated for Beltsville, Maryland.

Master planning and development of	Months 1 through 4
design program	Months 1 through
Design of interim alterations	Months 1 through
Construction of interim alterations	Months 4 through 12
Design of permanent alterations	Months 10 through 28
Construction of permanent alterations	Months 13 through 28
Permanent occupancy	

# MODIFICATIONS

This memorandum of Understanding can be amended or modified at any time

For signature by the Secretary and the GSA Administrator

Transmitted via telecopier to Bareau of The Mint, 6-11-75, @ 9:00am. Followed up by telephone call to Communications Center at Mint to request their assistance in transferring papers to Main Treasury Bldg. pronto! 6/13 (Whipps of Lovies Harris 6/13) (Jm) Dean Resent draft meno- she notified Your mytchece. I motified Frenco of (seley Abris Harris) it had have sent at 0855 this date

From: Fronk Rlee
TO: J. Mangels
Rm 1454 MT

Comments on Draft Memorandum of Agreement Between GSA and Treasury for CFLETC at Glynco Naval Air Station, Brunswick, Georgia

- 1. The draft memo of agreement appears to be basically sound and comprehensive. As usual, however, some revisions are considered appropriate. The following comments are keyed to the draft memo:
- Page 1, Policy, Para. A. The location of the GSA Project Manager is not specified. Some monitoring of the project from GSA Headquarters is prudent, but due to the complexity and magnitude of the project, the GSA Project Manager should be located in the GSA Atlanta Regional Office initially, and then should be stationed at Glynco during most of the design/construction period. (Also, a CFLETC project representative should work closely and continuously with the GSA Project Manager for the life of the Project.)
- Page 5, Para. (11). This paragraph needs to be rewritten to express clearly what is meant; "Approved performance parameters" is a very obscure term.
- Page 6, Para. (14). It is my understanding that sufficient funds have been appropriated by the Congress to complete all work required at Glynco for the CFLETC. The need for "a plan of action" for acquiring project financing appears questionable. Also, per paragraph (7) on page 15, Treasury is to provide required funds to GSA upon approval of the Project Master Plan.
- Page 7, Para. (21). It is GSA's standard policy to employ a Construction Manager (CM) on any project of consequence. This CM concept is highly debatable on any project, but for the work to be done at Glynco, a CM is completely unnecessary, particularly because most of the construction will consist of rehabilitation and alteration of existing facilities. The new structures required are relatively small and uncomplicated. The GSA Project Manager should perform all management, coordination and general direction functions directly with his own staff. Inspection of construction and equipment installation is a necessary task, which should be performed by the GSA Project Manager using government employees, or services provided by the A/E under Title II of the standard A/E contract. Introduction of a CM on this project will serve only to increase requirements for coordination and communication, with the probable result being creation of confusion, delay and additional costs.
- Page 9, Para. D(1). This section should be enlarged by requiring GSA to prepare rigid, definitive rules (subject to Treasury approval) as to which officials will have authority to make charges to the project.
- Page 15, Para. (9). As the companion to this paragraph, GSA should provide Treasury with a copy of all correspondence relating to this project, including all internal correspondence.

- Page 15, Para. (10). The requirements of NEPA have already been met, so this paragraph is unnecessary.
- 2. The following additional provisions should be incorporated in the agreement:

# GSA Functions, etc.

- a. Furnish Treasury with all deeds, free and clear of legal encumbrances and obligations, to the real property included in the project, and transfer title to the Treasury at the time of permanent occupancy.
- b. Furnish Treasury with one set of paper reproducibles (sepias) of all final working drawings. As-built plastic reproducibles of all working drawings will be maintained during the life of the project, and one set will be provided to Treasury after project completion.
- 3. Consideration should be given to the matter of Treasury participation in the selection of, and negotiation of contracts with, the A/E(s) and the CM (if Treasury agrees to the use of a CM). For such a special purpose facility, Treasury should participate in these actions to assure that competent and appropriately experienced firms are selected and that the contract terms, including fees, are proper. Lastly, Treasury should have the opportunity to approve all bid packages before they are issued.

FRANK W. RHEA

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CFLETC Pupe agreement



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# CHRONOLOGY OF EVENTS CONSOLIDATED FEDERAL LAW ENFORCEMENT TRAINING CENTER

.

DATE	ACTION
1953	U.S. Secret Service School conducted in Sloan Building in Washington
1956	Treasury Law Enforcement School occupied Sloan Building
March 2, 1965	Prospectus submitted for U.S. Secret Service Training Center at Beltsville, Maryland
April 7, 1965	House Public Works Committee approval of U.S. Secret Service Training Center Prospectus
April 13, 1965	Senate Public Works Committee approval of U.S. Secret Service Training Center Prospectus
February 11, 1966	GSA initiated design of U.S. Secret Service Training Center
May 12, 1966	Letter to Administrator, GSA, from FRI Director Hoover that use of the FBI Quantico facility not feasible
May 14, 1966	Letter to Administrator, GSA, from Secret Service Director Rowley that use of the FBI Quantico facility not feasible
June 1967	BoB Survey of Federal Law Enforcement Training facilities (revised draft)
March 4, 1968	61 acres transferred to Treasury control
July 19, 1968	\$800,000 appropriated to U.S. Secret Service for construction of U.S. Secret Service Training Center
September 5, 1968	Interagency Proposal for Consolidated Federal Law Enforcement Training Center at Beltsville

DATE	ACTION
January 13, 1969	Prospectus submitted for CFLETC at Beltsville. This Prospectus superseded the March 2, 1965, U.S. Secret Service Prospectus.
May 5, 1969	House Public Works Committee approval of CFLETC Prospectus
May 15, 1969	Senate Public Works Committee approval of CFLETC Prospectus
September 29, 1969	\$700,000 appropriated to U.S. Secret Service for construction
September 29, 1969	\$1 million appropriated to the CFLETC for design of the Beltsville facility
January 1, 1970	National Environmental Policy Act became effective
February 26, 1970	FY 1971 House Appropriations Committee Hearing
March 2, 1970	Treasury Order No. 217 established the CFLETC
May 25, 1970	FY 1971 Senate Appropriations Committee Hearing
May 26; 1970	CFLETC Interagency Working Group Meeting No. 1
June 10, 1970	CFLETC Interagency Working Group Meeting No. 2
June 17, 1970 -	CFLETC Interagency Working Group Meeting No. 3
June 24, 1970	CFLETC Interagency Working Group Meeting No. 4
July 1, 1970	Treasury Law Enforcement Training School merged with the CFLETC
July 1, 1970	CFLETC Interagency Working Group Meeting No. 5
July 16, 1970	Submission of draft Preliminary Master Plan to the National Capital Planning Commission and withdrawn on September 2, 1970, to allow study and response to recommended improvements.

July 16, 1970

CFLETC Interagency Working Group Meeting No. 6

DATE	<u>ACTION</u>
July 28, 1970	Submission of Draft Environmental Statement to the Council on Environmental Quality
July 28, 1970	Meeting No. 1 of the Center Board of Directors
July 29, 1970	CFLETC Interagency Working Group Meeting No. 7
August 5, 1970	CFLETC Interagency Working Group Meeting No. 8
August 7, 1970	CFLETC Interagency Working Group Meeting No. 9
August 10, 1970+	Prince George's County Planning Board Resolution No. 70 expressed disapproval of the Center project
August 12, 1970	CFLETC Interagency Working Group Meeting No. 10
August 14, 1970	CFLETC Interagency Working Group Meeting No. 11
August 19, 1970	CFLETC Interagency Working Group Meeting No. 12
August 25, 1970	Letter from Mr. William Gregg (General Services Administration) to Mr. W. C. Dutton, Jr., Chairman of the Prince George's County Planning Board - thanked Mr. Dutton for the opportunity to brief the Planning Board regarding the Center and offered to provide additional information to the Planning Board regarding the Center
	CFLETC Interagency Working Group Meeting No. 13
August 31, 1970  September 26, 1970	\$5 million appropriated to the CFLETC for design and construction of Beltsville facility
September 30, 1970	Memorandum of Understanding for the Sponsorship and Operation of the Consolidated Federal Law Enforcement Training Center signed
October 15, 1970	Meeting No. 2 of the Center Board of Directors
November 30, 1970	Treasury Air Security Officers School created as a division of the Center
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DATE	ACTION
December 16, 1970	CFLETC Interagency Working Group Meeting No. 14
January 27, 1971	CFLETC Interagency Working Group Meeting No. 15
February 10, 1971	CFLETC Interagency Working Group Meeting No. 16
March 8, 1971	FY 1972 House Appropriations Committee Hearing
March 17, 1971	CFLETC Interagency Working Group Meeting No. 17
March 22, 1971	CFLETC Interagency Working Group Meeting No. 18
March 25, 1971 *	Guidance for the CFLETC issued
March 25, 1971	Meeting No. 3 of the Center Board of Directors
March 29, 1971	CFLETC Interagency Working Group Meeting No. 19
March 31, 1971	Revised Prospectus submitted for the CFLETC
April 20, 1971	House Public Works Subcommittee Executive Hearing on revised Prospectus for the CFLETC
April 26, 1971	CFLETC Interagency Working Group Meeting No. 20
April 27, 1971	FY 1972 Senate Appropriations Committee Hearing
May 4, 1971	House Public Works Subcommittee Executive Hearing on revised Prospectus for the CFLETC
May 6, 1971	House Public Works Full Committee approval of revised Prospectus for the CFLETC
May 12, 1971	Final Environmental Statement submitted to Council on Environmental Quality
May 12, 1971	Preliminary Master Site Plan submitted to National Capital Planning Commission

to provide water and sewage services for the CFLETC

Washington Suburban Sanitary Commission proposed

May 21, 1971 TASOS FY 1971 classes completed

May 12, 1971

DATE	ACTION
May 26, 1971	GSA in letter to the Acting Chairman of the National Capital Planning Commission submitted additional data in support of Preliminary Master Plan and expressed hope information would be of value to Prince George's representatives (included supplemental data on Housing)
May 27, 1971	CFLETC Interagency Working Group Meeting No. 21
June 10, 1971	Commissioner, Public Buildings Service, GSA, wrote Mr. Gullett, Prince George's County Executive, and transmitted directly copies of the Preliminary Master
Jean St. 1979	Plan drawings and report, the Guidance document and the Final Environmental Statement (Prince George's County was also advised of CFLETC plans
•	through normal National Capital Planning Commission coordination procedures
June 16, 1971	Treasury, GSA and NCPC officials and the architect briefed the Maryland-National Capital Park and Planning Commission on the Master Plan for the CFLETC
June 18, 1971	Letter from General Services Administration to the Acting Chairman, National Capital Planning Commission, submitted additional data (on transportation, control of
*	noise, and socio-economic considerations) in support of the Preliminary Master Plan
June 23, 1971	Prince George's County Planning Board meeting (Treasury presentation not allowed as scheduled)
July 1, 1971	Hearing on CFLETC by Public Safety Policy Committee of the Metropolitan Washington Council of Governments
July 2, 1971	Chairman, Prince George's County Planning Board, wrote Treasury and included staff report (in form of draft resolution) being forwarded to the National Capital Planning Commission
July 9, 1971	\$21 million appropriated to CFLETC for design and construction

	•
DATE	ACTION
July 15, 1971	County Council of Prince George's County passed resolution #51 opposing the CFLETC and requested the Washington Suburban Sanitary Commission not to provide water and sewerage services to the CFLETC
July 15, 1971	Senate Public Works Subcommittee Hearing on the Revised Prospectus for the CFLETC
July 16, 1971	381 acres of land transferred to the Treasury Department for the site of the CFLETC
July 22, 1971	Senate Public Works Subcommittee Hearing on the Revised Prospectus
July 23, 1971.	Hearing on CFLETC by Land Use Committee of the Metropolitan Washington Council of Governments
July 27, 1971	Washington Suburban Sanitary Commission General Counsel, by letter, informed GSA that the Washington Suburban Sanitary Commission has suspended its May 12 offer of water and sewerage, without efficacy, until further action of the Commission
July 28, 1971	COG adopted resolution opposing location of CFLETC facilities at Beltsville.
July 30, 1971	Five citizens' associations in upper part of Prince George's County wrote to National Capital Planning Commission expressing opposition to location of CFLETC facilities at Beltsville
August 3, 1971	GSA informed Washington Suburban Sanitary Com- mission General Counsel, by letter, that the Federal Government questioned the basis for such action and
	stated the Washington Suburban Sanitary Commission letter would be examined carefully
August 3, 1971	Mr. Arthur F. Sampson, Commissioner, Public Buildings Service, GSA, met with Senator Gravel to provide additional information related to the Center
August 4, 1971	Federal Planning and Projects Committee of the

National Capital Planning Commission approved the Preliminary Master Plan for the CFLETC

DATE	ACTION
August 5, 1971	National Capital Planning Commission approved the Preliminary Master Plan for the CFLETC
August 23, 1971	TASOS began FY 1972 training program
August 27, 1971	Answers to Subcommittee Questions submitted to the Senate Public Works Subcommittee by Treasury
September 7, 1971	Letter to National Capital Planning Commission trans- mitted Final Master Plan Report and Drawings, to- gether with additional data on sewer and water arrangements, the lake, impervious surfaces, and visual and sound buffers.
October 4, 1971	Representatives of Treasury and GSA appeared before Prince George's County Council, which does not modify its position
October 7, 1971	National Capital Planning Commission approved certain basic elements of Master Plan for facilities of CFLETC
October 13, 1971	CFLETC Interagency Working Group Meeting No. 22
November 18, 1971	Senate Public Works Committee approves revised Prospectus
November 27, 1971	Special Training Building was occupied
January 6, 1972	Meeting No. 4 of the Center Board of Directors
January 6, 1972	Investigators from the Office of Investigations, GSA, accepted for training at the Center.
January 19, 1972	CFLETC Interagency Working Group Meeting No. 23
January 27, 1972	First Director of CFLETC sworn in
February 9, 1972	Maryland-National Capital Park and Planning Commission and District Council for Prince George's County instituted action against GSA and Treasury, seeking injunction against any further construction of CFLETC facilities at Beltsville, on principal

allegation that that environmental impact statement filed in 1971 was not in compliance with National

Environmental Policy Act

DATE	ACTION
February 18, 1972	Butler concurs with opinions of Justice Department and Treasury lawyers that new EIS is required, and approves stipulation that no contracts will be awarded until two weeks after Plaintiffs had been notified.
March 3, 1972	Oral stipulation by defendants that construction will be deferred until a new EIS is prepared and filed.
March 8, 1972	FY 1973 House Appropriations Committee Hearings
March 22, 1972	Plaintiffs file amended complaint, correcting designation of parties defendent.
March 1972	Director Butler, CFLETC, determines that new environmental impact statement will be filed.
March 23, 1972	FY 1973 Senate Appropriations Committee Hearings
March 30, 1972	CFLETC Interagency Working Group Meeting No. 24
April 4, 1972	Meeting No. 5 of the Center Board of Directors
April 11, 1972	Defendants file answer to amended complaint.
April 21, 1972	CFLETC Interagency Working Group Meeting No. 25
May 11, 1972	District Court denies motion for preliminary injunction on basis that new environmental impact statement will be filed.
June 19, 1972	Calverton Citizens Association files motion to intervene in complaint.
June 19, 1972	Letter to Honorable Kent Frizzell, Assistant Attorney General, Land & Natural Resources Division, Department of Justice from W. H. Sanders, Acting Commissioner, Public Buildings
	Service, General Services Administration,
	requested that a condemnation proceeding be instituted.

DATE	ACTION
June 23, 1972	U.S. District Court Judge Corcoran holds conference with litigants in chambers in which he indicates that condemnation should not be instituted against Tidler Tract.
June 27, 1972	Letter to Harold Buehler, Deputy Project Manager, CFLETC, General Services Administration from William L. Dickey, Deputy Assistant Secretary, Department of the Treasury, notified them not to proceed with the condemnation.
July 10, 1972	Police School began full operation
July 12, 1972	Defendants file stipulation (dated July 3) agreeing not to undertake any new construction, thus avoiding issuance of an injunction
July 25, 1972	Meeting No. 6 of the Center Board of Directors
August 1, 1972	New Draft Environmental Impact Statement filed with Council on Environmental Quality
October 3, 1972	Meeting No. 7 of the Center Board of Directors
November 24, 1972	New Final Environmental Impact Statement filed with Council on Environmental Quality
November 22, 1972	Beltsville Agricultural Research Center agreed to Treasury Request to provide permanent sewage treatment service
November 24, 1972	Memorandum of Director, CFLETC, recommending favorable decision on proposed Beltsville facilities
November 28, 1972	Memorandum of Director, CFLETC, Making Supplemental Recommendation on Sewerage
January 4, 1973	Meeting No. 8 of the Center Board of Directors
January 4, 1973	National Capital Planning Commission approval of Revised Master Plan

DATE	ACTION
January 5, 1973	Decision by Assistant Secretary of the Treasury on Proposed Beltsville Facilities
January 29, 1973 .	GSA issues Invitation for Bids on clearing and grubbing. Justice notifies plaintiffs' attorney that invitation is issued.
February 6, 1973	Plaintiffs file motion for permission to amend bill of complaint.
February 28, 1973	District Court grants motion to amend complaint.
March 7, 1973 .	Plaintiffs file motion for preliminary injunction.
March 13, 1973	Defendants file answer to amended motion for preliminary injunction.
March 13, 1973	FY 1974 House Appropriations Committee Hearings
March 20, 1973	CFLETC Interagency Working Group Meeting No. 26
March 26, 1973	Defendants file motion for summary judgment
March 27, 1973	CFLETC Interagency Working Group Meeting No. 27
April 12, 1973	Meeting No. 9 of the Center Board of Directors
April 12, 1973	Investigators and Rangers of the U.S. Forest Service, Department of Agriculture and Investigators of the Federal Protective Service, GSA, accepted for training at the Center. The continued participation of the National Marine Fisheries Services was noted. As the Bureau of Commercial Fisheries in the Department of Interior, included by Interior signing the original Memorandum of Understanding. As bureau in the Department of Commerce effective 1970, continued participation.
April 24, 1973	Plaintiffs file opposition to motion for summary judgment.

DATE	ACTION
May 4, 1973	FY 1974 Senate Appropriations Committee Hearings
May 4, 1973	A hearing on the defendants' motion for summary judgment for dismissal of the suit by the Maryland-National Capital Park and Planning Commission (M-NCPPC) and Prince George's County Council was
	held in the U.S. District Court for the District of Columbia. On the other hand, the plaintiffs sought a preliminary injunction against further activities with respect to construction of the Beltsville facility
May 11, 1973	The Court rules that the final Environmental Impact Statement completely fulfilled the requirements of Section 102(2) of the National Environmental Policy Act, and therefore granted the motion for dismissal
	and denied the plaintiffs' motion for preliminary injunction
May 31, 1973	Letter to GSA, CFLETC Project Manager, from Deputy Assistant Secretary Moody notifying them to proceed with condemnation
June 1, 1973	Clearing and Grubbing Contract let
June 8, 1973	The M-NCPPC filed a notice of appeal from the Court's May 11 order.
June 14, 1973	Appellants file motion in Court of Appeals for injunction pending appeal. (Despite provisions
	of Rules, Plaintiffs did not first seek injunction in District Court. Court of Appeals ignored this violation of rules, although it was called to Court's attention by Justice.)
June 29, 1973	CFLETC Interagency Working Group Meeting No. 28
July 3, 1973	Meeting with GSA and Justice related to con- demnation of a parcel of private land

July 9, 1973

CFLETC Interagency Working Group Meeting No. 29

DATE	ACTION
July 14, 1973	The plaintiffs filed in the U.S. Court of Appeals for the District of Columbia a motion for injunction pending appeal, contending that the District Court had erred in its decision
July 19, 1973	Justice submitted a memorandum in opposition to the application for injunction
July 23, 1973	The Court of Appeals temporarily enjoined the defendants from proceeding with clearing and/or grading and allowed them ten days to show cause why the decision of the District Court should not be summarily reversed.
July 23, 1973 (9:00 a.m.)	GSA, CFLETC Project Director officially notified to stop clearing and grubbing at Beltsville
July 23, 1973	Meeting with GSA and Justice related to condemnation of a parcel of private land
July 25, 1973	House Committee on Appropriations, Report (to accompany H.R. 9590) No. 93-399, disallows the request for \$6,000,000 for continued construction at Beltsville
August 2, 1973	Justice submitted a brief showing stated cause from Court's July 23 order
August 6, 1973	CFLETC Interagency Working Group Meeting No. 30
August 7, 1973	Appellants filed a response
August 9, 1973	CFLETC Interagency Working Group No. 31
August 16, 1973	Meeting No. 10 of the Center Board of Directors
August 17, 1973	CFLETC Interagency Working Group Meeting No. 32
August 22, 1973	CFLETC FY 75 budget presentation to Treasury Office of Budget and Finance

#### DATE

August 22, 1973

September 27, 1973

October 26, 1973

December 5, 1973

December 11, 1973

December 12, 1973

December 20, 1973

January 2, 1974

#### ACTION

Court of Appeals handed down an order denying summary reversal of the District Court decision, yet continuing the injunction against clearing and grubbing until disposition of this appeal on the merits after full briefing by the parties."

Appellants filed their brief contending: the District Court erred: (1) in limiting the review of the Environmental Impact Statement to requiring a mechanical compliance with the requirements of NEPA; (2) in determining that no substantive requirements of NEPA on material facts were in issue; and (3) in denying appellants' motion for a preliminary injunction and in granting appellees' motion for summary judgment.

Appellees filed its brief in the U.S. Court of Appeals for the District of Columbia contending that (1) the decision by the Assistant Secretary of the Treasury to authorize expansion of the Training Center at Beltsville was lawful under the National Environmenta Policy Act of 1969 and the District Court of the District of Columbia properly refused to set it aside by injunction; and (2) the Environmental Impact Statement is adequate.

CFLETC Interagency Working Group Meeting No. 33

Meeting of NCPC - Eckert, Buehler, West, Ray Nixon, Special Assistant to the Commissioner, PBS for National Capital Affairs, Director and Deputy Director, CFLETC

Meeting No. 11 of CFLETC Board of Directors

Court of Appeals orders scheduling of case for argument as promptly as business of the Court permits.

Meeting with NCPC staff to discuss the Center's submission in connection with the revision to the Master Plan showing the modified driving range complex and the preliminary site and building plans for the driving range complex.

DATE	ACTION
January 9, 1974	Hearing before the NCPC Planning and Projects Committee on modified driving range complex cancelled.
January 10, 1974	Hearing before the NCPC on the submission of the modified driving range complex.
January 29 & 30, 1974	Seminar conducted at Center facilities by and for training officers of the Center's participating agencies relative to individual agency input into CFLETC training and feedback to the agencies by CFLETC staff.
February 1, 1974	Inspection made of Bainbridge Naval Training
	Center as an alternate CFLETC site by six top members of the Center staff, four men from GSA, including two estimators familiar with the costs and renovations and the architect in day to day charge of the CFLETC project.
February 28, 1974	Memorandum from Center Director to the Acting Assistant Secretary discussing alternatives for acquiring Center facilities and reaffirming prior recommendations that the Center proceed with construction of CFLETC facilities at Beltsville.
March 1, 1974	Letter from Butler to Elting Arnold, Special Assistant to General Counsel re EIS on the up- grading and expansion of the WSSC Piscataway Wastewater Treatment Facility.
March 11, 1974	Congressman Roybal's office phoned requesting CFLETC's latest minority employment figures.
March 12, 1974	Hearing before House Appropriations Subcommittee
March 13, 1974	Hearing before the U.S. Court of Appeals for the District of Columbia re law suit.
March 13 & 14, 1974	Panel established and convened for purpose of selecting candidates to fill two instructor positions in the CFLETC.

DATE	ACTION
March 14, 1974	Conference with Mr. Charles Floyd from the
	Physical Fitness Institute re complete conditioning program.
April 1, 1974	ADP Financial Plan for CFLETC submitted to ADP
	Planning and Policy Division, Office of Computer Science, Treasury.
April 3 & 4, 1974	Hearing for NCPC Planning and Projects Committee
	on Driving Ranges approved preliminary site and building plans for driving range building.
April 4, 1974	Memo from Butler to Office of Management and
June 8 : 5074	Organization, Planning and Evaluation Division, submitting FY 1976 Spring Budget Preview Docume
April 22, 1974	Architect was authorized to develop an Energy Conservation Study.
April 25, 1974	Evangeline House - inspection made re additional CFLETC facility.
	Creero facility.
May 8, 1974	U.S. Court of Appeals for the District of Columbia affirmed May 11, 1973 judgment of U.S. District
	Court that the government had complied with the National Environmental Policy Act
May 14, 1974	Letter from Assistant Secretary Macdonald to
	Senator Montoya and Congressman Tom Steed in- forming them of the favorable decision of the law suit
May 21, 1974	Budget hearings before Senate Appropriations Subcommittee on FY-75 budget.
May 22, 1974	CIWG Meeting No. 34
May 22, 1974	Appellants file Petition for Rehearing en banc and Motion for Continuance of Temporary Injunction Pending Appeal.
May 29, 1974	First class for Customs Patrol Officers started.
May 31, 1974	Board Meeting #12

### DATE ACTION June 3, 1974 Letters for Congressional Committees were cleared by Congressional Liaison Office of GSA and sent to Office of Administrator. Meeting with Arnold Weiner, Justice, and GSA June 5, 1974 representatives regarding acquisition of Tidler Tract. June 5, 1974 Meeting with Butler, Ray Hayes and Dr. J. Allen Offen, re negotiations of purchase of 45,8683 acres owned by Dr. Offen and his associates. June 6, 1974 Letter from Administrator Sampson to Congressman John A. Blatnik and Senator Jennings Randolph advising that he planned to proceed and advertise the awarding of bids for the site preparation and initial items of construction unless advised within 30 days that either objected. Acting Commissioner, PBS, signed off on Revised June 11, 1974 Prospectus. June 13, 1974 Letter to Honorable Wallace Johnson, Assistant Attorney General, Land & Natural Resources Division, Justice, from John Galuardi, Acting Commissioner, PBS, requesting that a Condemnation Proceeding be instituted and Declaration of Taking be filed. Declaration of Taking filed with Court. June 18, 1974 June 20, 1974 OMB letter approving Revised Prospectus. Visit by Assistant Secretary Macdonald to Center. June 20, 1974 Meeting with Efteland, Raymond A. Hayes, Arnold June 21, 1974

Weiner, Harry Schupe, Roy Eckert and Harold R. Buehler re taking possession of the 45.8683 acres.

DATE	ACTION
June 24, 1974	Briefing of staff of Senate Public Works Committee with Ms. Feller, Eckert, Loy Shipp, Butler, John Purinton and Harold Brayne re law suit, increases in cost estimate, agencies for whom training is being given, and the first contracts to be let
June 25, 1974	Letter from Butler to Talcott Edminster, Agric- ultural Research Center, requesting that the Beltsville Agricultural Research Center furnish water on a permanent basis to the Center's Beltsville facilities.
June 26, 1974 •	Conference to furnish Arnold Weiner, Justice, information re Condemnation Action - property to be acquired and property in the surrounding area.
June 27, 1974	Letter of transmittal on Revised Prospectus cleared by all subordinate offices in GSA and sent to Congressional Liaison Office for presentation to Administrator.
June 27, 1974	Administrator Sampson signed letter transmitting Revised Prospectus.
June 27, 1974	Amended Prospectus submitted to the Congress.
June 30, 1974	Notice to vacate given to tenants on Tidler Tract
July 3, 1974	Preliminary Report on Energy Conservation Study discussed with architects.
July 5, 1974	Appellants' petition for rehearing en banc denied
July 8, 1974	Annual Report submitted for FY-74.
July 12, 1974	Appellants file motion for stay of mandate pending application for certiorari.
July 15, 1974	Target date for advertising (referred to as Bid Invitation Date).

DATE	ACTION
July 18, 1974	Rationale for a Soft Prospectus submitted to Assistant Secretary Macdonald.
July 22, 1974	Letter from Eckert to Butler submitting copy of primary energy study for Center.
July 31, 1974	Letter to Henry Peterson (Justice) from Assistant Secretary Macdonald re DEA participation in the Center.
August 1, 1974	Briefing with Ms. Bernice Oertel, House Committee on Public Works re revised Prospectus
August 1, 1974 *	Letter from Kenneth R. Harding, Chairman, U.S. Capitol Police, stating approval of participation of U.S. Capitol Police in the Center's training program.
August 2, 1974	Telegram from Senate Public Works Committee requesting responses concerining participation, for hearing to be held on August 8, 1974.
August 8, 1974	Hearing on revised Prospectus before the Senate Subcommittee on Public Buildings and Grounds.
August 19, 1974	CFLETC's Annual Report submitted
August 21, 1974	Hearings on revised Prospectus before House Subcommittee on Public Buildings and Grounds
August 23, 1974	- Budget hearingTreasury
August 23, 1974	CFLETC presented its budget request for FY-76.
August 26, 1974	Agriculture granted permission to Treasury for temporary water service during construction at Beltsville.
August 30, 1974	Final response forwarded to GSA for inclusion in the record to questions presented by the Senate Subcommittee on Public Buildings and Grounds.
September 4, 1974	Energy Conservation Study received.
September 17, 1974	CFLETC prepared Talking Paper for Secretary Simon re request for increase in authorization

Simon re request for increase in authorization

DATE		ACTION
	*	for construction of Beltsville facilities.
September 18, 1974		Treasury testified at hearings before the Senate Subcommittee on Public Buildings and Grounds on revised Prospectus.
September 22, 1974		Annual Conference of the International Association of Chiefs of Police began in Washington, D.C.
September 23, 1974	,	CFLETC requested advice of General Counsel, Treasury, concerning the jurisdiction over CFLETC site at Beltsville.
September 27, 1974		CFLETC presented its plan for FY-75 Federal outlays.
October 7, 1974		Assistant Secretary Macdonald and Deputy Assistant Secretary Clawson met with Senator Scott concerning revised Prospectus.
October 21, 1974		GSA transmitted to the Senate Subcommittee on Buildings and Grounds answers to questions presented at the hearings on September 18 re request for increase in the authorization for construction of Beltsville facilities.
October 22, 1974		Action initiated to determine if Declaration of Taking in condemnation action does not take all the land south of the proposed outer beltway.
October 30, 1974		Statement concerning Impact of OMB target level on FY 76 appropriations submitted to Treasury, Office of Budget and Finance.
		Supplemental statement for transcript of hearings before Senate Subcommittee on Buildings and

Grounds on September 18 submitted to Deputy

Assistant Secretary Clawson.

# **DEPARTMENT OF THE TREASURY**

Consolidated Federal Law Enforcement Training Center

A FRANK PHEA. USSS 1,000 eflere 1971 1976 fudget Excess on 61, 360,760 att 62,013 Director

1310 L Street, N.W.

Washington, D.C. 20220

Room 904 964-8551



### DEPARTMENT OF THE TREASURY

WASHINGTON, D.C. 20220

Mr. Robert Ferneau
The Special Assistant to the
Secretary of the Navy
Department of the Navy
Washington, D.C. 20350

Dear Mr. Ferneau:

Subject to approval by the appropriate Congressional authorities, the Treasury Department desires to have transferred to it, as a site for the Consolidated Federal Law Enforcement Training Center (CFLETC), the sections of the Glynco Naval Air Station, Brunswick, Georgia, together with all the improvements now thereon, within the heavy black lines on the copy of the map designated Map 10, Existing Facilities and Proposed Areas, Glynco Naval Air Station, prepared by Eric Hill Associates, Inc., dated October 22, 1974. (See Enclosure 1.) Upon receipt of Congressional approval, Treasury will formally request the transfer of the real property, plus the personal property related thereto.

Pending the Congressional decision, it is requested that the Department of the Navy retain all of the above mentioned real estate, together with the personal property related thereto. (This includes equipment in storage as well as that still in buildings.)

It is also requested that the Navy retain at the Glynco Naval Air Station the Navy personnel presently stationed there and the civilians employed by the Navy to help operate and maintain the base pending receipt of the anticipated Congressional decision authorizing the CFLETC to move to the site. Following such decision the CFLETC desires to make an agreement with the Navy to have the Navy use such personnel on a reimbursable basis to help renovate the site to meet Treasury requirements. It will be to the benefit of the U.S. Government if Commander Robert N. Booth, Public Works Officer, and his staff with their intimate knowledge of the facilities can be retained.

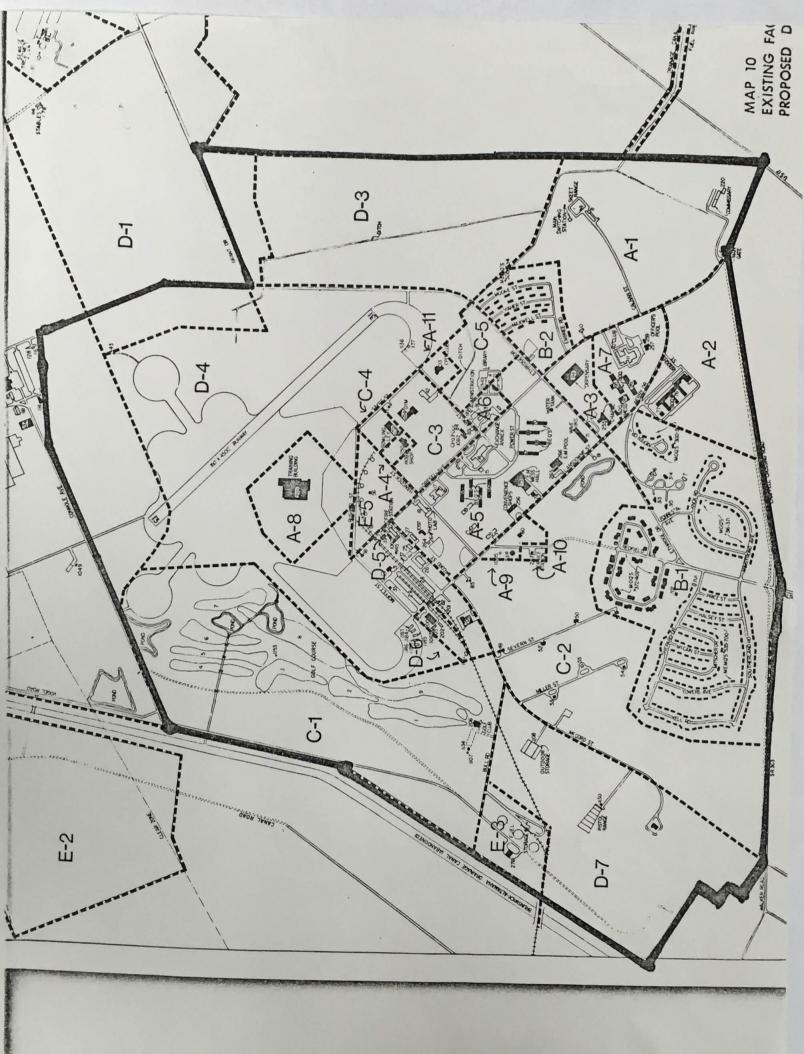
It is expected that the Congressional decision will be received before the end of this fiscal year. If that decision is favorable, the Treasury Department will move as quickly as feasible to work out final arrangements for the transfer of the property to the Treasury Department and the adaptation of it for use by the CFLETC.

That adaptation will require a substantial renovation and repair of the existing facilities and construction of some additional facilities. Treasury desires to seek assistance from the Department of the Navy, particularly the retention of the present Public Works Officer, Commander Booth, and appropriate members of his staff for the period of time required to adapt the facilities. (Preliminary GSA estimates are that this will take between three and three and a half years to accomplish.) The Treasury Department would reimburse the Department of the Navy for the services of Commander Booth and other Naval personnel in connection with this permanent renovation work. The CFLETC will seek to employ as many of the civilians now on the Navy's rolls as will be needed.

Sincerely,

David R. Macdonald
Assistant Secretary (Enforcement,
Operations, and Tariff Affairs)

Enclosure



JENNINGS RANDOLPH, W. VA., CHAIRMAN DMUND S. MUSKIE, MAINE SEPH M. MONTOYA, N. MEX. IKE GRAVEL, ALASKA OYD BENTSEN, TEX. TENTIN N. BURDICK, N. DAK. CK CLARK, IOWA

HOWARD H. BAKER, JR JAMES L. BUCKLEY, N. ROBERT T. STAFFORD, WILLIAM L. SCOTT, VA. JAMES A. MC CLURE, IDAHO PETE V. DOMENICI, N. MEX.

M. DARRY MEYER, CHIEF COUNSEL AND CHIEF CLERK BAILEY GUARD, MINORITY CLERK

# Miled States Senate

COMMITTEE ON PUBLIC WORKS WASHINGTON, D.C. 20510

December 12, 1974

Pupped by: Complimate cyle with l'ar Fer Aption (Printal) popter Redy Significant whi urnish Copy of Regly to: Charge also REPLY DUE!

Honorable Arthur F. Sampson Administrator General Services Administration 18th and F Streets, N.W. Washington, D. C. 20405

Dear Mr. Sampson:

On December 10 the Public Works Committee of the U.S. Senate met in Executive Session, to consider a pending prospectus authorizing additional funds for the proposed Beltsville, Maryland Law Enforcement Training Center.

Since this project was initially authorized, inflation and subsequent changes have escalated the estimated cost to an extent that Members now question the wisdom of expediting the plan in its present concept. It is the Committee consensus that if an existing inactive or surplus military or other Federal facility could be feasibly converted to such purpose, substantial savings might be achieved.

In order to effectively pursue this conviction, I request that you conduct a survey of and evaluate all suitable mainland installations in these categories, which either are or will be available within the next two or three years, and submit a descriptive report to the Committee not later than February 28, 1975. Such survey and report shall be precise and definitive, reflecting exhaustive exploration, and be expedited without prejudice. Their importance, in this instance, cannot be overemphasized.

Your prompt compliance will be genuinely appreciated.

With warm regards, I am,

S'ROTARIO KIROA SBLIR & FILES

Jennings Randolph

Randolph

Chairman



# THE SECRETARY OF THE TREASURY WASHINGTON 20220

### MAR 281975

Dear Mr. Chairman:

In accordance with a request by the Chairman of the Senate Committee on Public Works of December 12, 1974, the Department of the Treasury, jointly with the General Services Administration and the Office of Management and Budget, has evaluated surplus and inactive Federally-owned properties to determine whether one of them might be adapted to provide suitable facilities for the Consolidated Federal Law Enforcement Training Center at a saving from the cost of completing the proposed facilities at Beltsville. A report of that survey was forwarded to you by GSA on March 24, 1975.

The report shows that facilities can be provided for the Consolidated Federal Law Enforcement Training Center at the Glynco Naval Air Station for an initial capital outlay of \$28,125,000, substantially less than the cost of completing the planned facilities at Belts-ville (approximately \$54.1 million). However, the report also shows that the additional cost of conducting all training operations at Glynco, as compared to Beltsville, is an estimated \$1 million per year. Nevertheless, in terms of present-value cost, establishing the Center at Glynco would require approximately \$14 million less than at Beltsville.

Other aspects of the siting of the CFLETC at Glynco have been considered and it has been determined to be a satisfactory site. In fact, the compact arrangement of the air station, the capabilities for future expansion, the on-base jet port to be operated by Glynn County, the on-base family housing for the Center staff, and the many other existing features which CFLETC could not afford at Beltsville, all combine into a physical plant offering every potential for the development of a true consolidated center for the highest order of professionalism in federal law enforcement training.

Brunswick governmental and community activities have extended a warm welcome to the Center and have indicated that utility services, fire protection and road maintenance will be available from local agencies. If satisfactory arrangements can be made to have transferred to Treasury that portion of the land and improvements at the Glynco Naval Air Station which are desired for the CFLETC facilities, and subject to a satisfactory resolution of environmental impact requirements, the Treasury Department, as lead agency for CFLETC, with the approval of the Center's Board of Directors, would like to move the Center's primary operation to Glynco as soon as satisfactory facilities can be made available there.

The General Services Administration estimates that it will be October of 1978 before all the work necessary to prepare the facilities at Glynco can be completed. The Center would like to move to Glynco before that date, if possible.

The Center is preparing a plan for interim occupancy. As soon as it is completed, GSA will estimate the extra cost entailed in accomplishing renovation and alteration of buildings while the plant is in operation. If that should be less than \$2 million, we believe the benefit to the Center and to the Glynn County area of the expedited occupancy would justify it.

The General Services Administration has advised that, in addition to the approximately \$7.5 million already obligated against the funds appropriated for construction of facilities for CFLETC, there are claims and costs of phasing out construction at Beltsville which may be as much as an additional \$1.3 million. The total of these sums, plus the \$28,125,000 estimated to be needed to provide the Center with proper facilities at Glynco and the probable extra cost of \$2 million for expedited occupancy, falls well within the amount of funds already appropriated for the planning and construction of facilities for the CFLETC.

Substantially all of the training projected to be given in CFLETC facilities can be given at Glynco. However, some of the advanced, in-service, refresher and specialized (AIRS) training may more advantageously utilize the facilities which now exist at Beltsville. The Center proposes to continue to operate Beltsville for that training. By doing so, the cost of travel attributable to operations at Glynco would be reduced, perhaps by as much as \$280,000 per year.

I request the approval of the Committee on Public Works of the House of Representatives for the plans outlined above, and particularly for the expenditure of not to exceed \$28,125,000 of the funds previously appropriated for construction of the Consolidated Federal Law Enforcement Training Center for the conversion and/or construction of facilities at the Glynco Naval Air Station, and the expenditure of not to exceed an additional \$2 million of those funds to expedite the time at which the facilities at Glynco can be occupied.

In view of the fact that the Navy is preparing to phase out much of its caretaker activity in a matter of weeks and to dispose of equipment and furnishings which could be used by the Center at considerable saving over new purchases, I request the earliest possible consideration of these proposals by the Committee. An early decision would permit Treasury to preserve intact a highly experienced public works force and prevent a costly deterioration of a plant now in excellent condition.

This report has been endorsed by the Center's Board of Directors and has the concurrence of the Office of Management and Budget.

Sincerely yours,

William E. Simon

The Honorable
Robert E. Jones, Jr., Chairman
Public Works Committee
House of Representatives
Washington, D. C. 20515

#### Dear Tex:

As you know, there have been recent discussions regarding the establishment of the Consolidated Federal Law Enforcement Training Center at the Glynco Naval Air Station, at Brunswick, Georgia, rather than completing construction of a new plant at Beltsville, Maryland, primarily because of reduced costs for acquiring a suitable plant at Brunswick. Indeed, on March 25, the Board of Directors of CFLETC recommended that Glynco Naval Air Station become the site for the Center.

The Navy is engaged in phasing out the Public Works Department at Glynco, consisting of several naval officers and enlisted personnel and about fifty civilian employees, many of these highly knowledgeable with respect to features of the current plant as well as the halted new construction which CFLETC would expect to resume. Segments of this Department are now scheduled to depart on March 31, April 16, and May 1. The Public Work Officer, Commander Booth, has orders to leave on April 16.

The station is in remarkably good condition for having been in caretaker status. Allowing it to deteriorate before Treasury can assume responsibility for the facility, if that is the ultimate decision, would cause useless expenses. Furthermore, CFLETC would want, if possible, to employ some of the experienced Fublic Works personnel in their present capacities.

Moreover, much equipment and many furnishings currently in place in buildings to be used by the Center will soon be disposed of by the Navy if not claimed by an activity taking over the station. The opportunity to acquire these represents a very considerable savings for CFLETC as compared to new purchases which would otherwise be necessary.

In view of the significant savings and operational benefits at stake, and inasmuch as a final approval of the Glynco site by the cognizant Congressional Committees may be somewhat deferred, Treasury proposes to confer with the Department of Defense on the Possibility of slowing its phase-out at Glynco until Treasury is in a position to make a positive commitment. I would appreciate having your advice and support in this matter.

Sincerely yours,

/s/David R. Macdonald

David R. Macdonald
Assistant Secretary
(Enforcement, Operations,
and Tariff Affairs)

Mr. Aubrey A. Gunnels
Subcommittee on Treasury
Postal Service, and General
Government Operations
Committee on Appropriations
House of Representatives
Washington, D. C. 20515



# THE SECRETARY OF THE TREASURY WASHINGTON 20220

# MAR 28 1975

Dear Mr. Chairman:

As requested in your letter of December 12, 1974, the Department of the Treasury, jointly with the General Services Administration and the Office of Management and Budget, has evaluated surplus and inactive Federally-owned properties to determine whether one of them might be adapted to provide suitable facilities for the Consolidated Federal Law Enforcement Training Center at a saving from the cost of completing the proposed facilities at Beltsville. A report of that survey was forwarded to you by GSA on March 24, 1975.

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This report has been endorsed by the Center's Board of Directors and has the concurrence of the Office of Management and Budget.

Sincerely yours,

William E. Simon

The Honorable Jennings Randolph, Chairman Public Works Committee United States Senate Washington, D. C. 20510

Grade	Admin. & Support	Service & Maint.	Perm. Instructors	Temp. Instructors	Agency Supervisors	STB	SS Trng. Div	Students	Total
Exec. Level	2				,		•		2
GS 18	-								-
17	2								2
16	3								3
15	11						1	135	147
14	12		30		15		2	202	
13	1.8	3	174	102	15		20	270	602
12	11	8	84	48	15	2	32	270	470
11	17	8						360	385
10	6	19							25
9	25	12						293	330
8	10	8							18
7	50	17					1 .	360	428
6	38 ·	14					1		53
5	60	59				1	1	360	481
4	18	38				5			61
3	8	142				1			151
									4
Total	291	328	288	150	45	9	58	2250	3419

Admin. Increase
Service & Maint.
Housing
Other
Instructors

1/3 of 750 base over the 1500 level

100% of 750 base over the 1500 level 1/3 of 750 base over the 1500 level 100% of 750 base over the 1500 level

Student Pipeline 40% Basic 60% Airs

### CFLETC 1500 STUDENTS

Grade	Admin. & Support	Service & Maint.	Perm. Instructors	Temp.	Agency Supervisors	STB	SS Trng. Div	Students	Total
Exec. Level	. 1	21202220			, .				1
GS 18	1								1
17	2								2
16	3								3
15	9						1	75	85_
14	9		20		15		2	112	?
13	16	3	116	68	15		20	150	388
12	13	6 .	56	32		2	26	150	285
11	14	7						225	246
10	4	14							18
9	19	8						188	215
8	7	7							14
7	39	1.3					1 .	300	353
6	23 .	9					1		33
5	50	41				1	1	300	393
4	15	30				5			50
3	8	110				1			1-3
Total	233	248	192	100	30	9	52	1500	2364

Admin. Increase Service & Maint.

Housing

Other Instructors

100% over 750 base 1/3 over 750 base 100% over 750 base

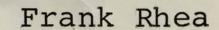
1/3 over 750 base

Student Pipeline 50% Basic 50% Airs

### CFLETC 750 STUDENTS

Grade	Admin. & Support	Service & Maint.	Perm. Instructors	Temp.	Agency Supervisors	STB	SS Trng. Div	Students	Total
Exec. Level					,				
GS 18	1								1
17	1								1
16	2								2
15	6						1	31	38
14	7		10		15		2	46	80
13	12	1	58	34			20	62	187
12	13	4 .	28	16		2	20	62	145
11	7	7						106	120
10	3	1							4
9	13	14					•	91	118
8	5	6							11
7	31	8					. 1	176	216
6	19	9					1		29
5	33	26 .				1	1	176	237
. 4	14	20				5			39
3	8	73				1			82
Total	175	169	96	50	15	9	46	750	1310

Student Pipeline 60% Basic 40% Airs



# TREASURY CRITERIA SUPPLIED OMB, GSA AND DOD FOR USE IN SURVEY OF POTENTIALLY AVAILABLE FEDERAL FACILITIES AS POSSIBLE ALTERNATES FOR THE CFLETC BELTSVILL. FACILITIES 1/2

The training requirements set forth in the <u>Guidance</u> for the <u>Consolidated</u> Federal Law Enforcement Training Center of March 25, 1971, and the completed design plans should be utilized for the sizes and types of requirements necessary to provide the level of training needed to increase the professionalism of Federal law enforcement agents and officers. Required Square Feet are:

	Net <u>Assignable</u>	Gross
Administration & Operations	29,072	42,518
Instruction	238,722	322,099
Physical Training	34,377	50,278
Housing & Dining	160,124	234,240
Service & Maintenance	38,541	50,232
TOTAL SQUARE FEET	500,836	699,367

Also, for adequate living, dining, and educational facilities the Center requires approximately 100 acres, 25 of which needs to be flat, cleared land for miscellaneous uses relating to the training of police officers; e.g., crowd and riot control, close order drill, etc. In addition, the Center requires at least 80 to 100 acres of land on which to conduct driver training. This may be in the form of an existing airport or other facility capable of conversion to outdoor driving ranges, or in the form of suitable flat, cleared acreage on which a driving range may be constructed. To conduct firearms training the Center requires utilization of existing firing ranges or 500-600 acres of space to construct outdoor ranges. To assure personnel safety, the acreage should be in the form of an inverted trapezoid with a width at the base of 500 feet spreading out to a depth of 20,000 feet. As an option, the Center would only need to utilize 10 acres for the construction of semi-enclosed firing ranges on the order of those presently operational at Beltsville, Maryland. (This would require an increase of from \$2-\$4 million in capital investment.)

<sup>1/</sup> Amends the December 20, 1974 Treasury Criteria to reflect revised gross square footage figures and net assignable square footage figures supplied by the General Services Administration.

It is preferable that all facilities be continguous. The distance between the dormitory and educational facilities should be within a walking distance which does not use up too much training time and the distance from these facilities to the firing and driving ranges should be within a twenty-minute bus trip.

Other than these general requirements, several specific requirements need to be met. They are:

- Adequate sewer and water services should be available without significant capital outlay.
- All utility services should be adequate to meet the projected workload and preferably to be provided and maintained by other than CFLETC personnel.
- 3. All structures should be in a reasonable state of repair, adaptable to normal GSA-level standards, and capable of maintaining proper temperature and humidity ranges without waste of energy.
- 4. The site should have reasonable accessibility to adequate housing for the staff of the facility.
- 5. The site should have reasonable accessibility to a sufficient local labor force required to operate the facility.
- 6. The site should have reasonable accessibility to air transportation and preferably be located near common carrier transportation facilities maintaining frequent schedules.
- 7. The Center could share a site with other Governmental elements as long as this does not interfere with or hamper the training programs.
- 8. The Center could share occupancy of administrative facilities with another appropriate Government agency.
  - 9. The Center could not share educational, living, and dining facilities.
  - 10. Existence of nearby recreational facilities would be highly desirable.

One overall requirement is that:

Sufficient total acreage is needed so that the density of occupancy per acre is low enough to meet any published standards of the planning commission of the local government which may have jurisdiction and the published standards of the environmental authorities having responsibility for approving the required Environmental Impact Statement.

Center Personnel Going to Glynco, Ga.

Grand Total 57

Grade	Total	Instructors	Clerical	Admin.
17	1			1
16	1			1
15	3			3
14	6	6		
13	16	12		4
12	5	3		2
11	1			1
10	1			1
9	5	4	1	
8	2			2
7	4		2	2
6	2		1	1
5	_			
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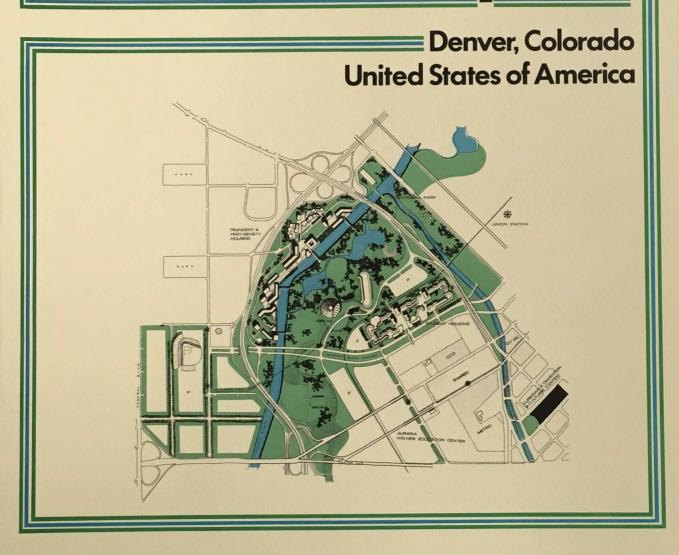
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Bicentennial



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- 6. An opportunity to observe these three major historical occasions in a way which does not produce costly, undefensible "white elephant" structures. Rather, to use the thrust of these events to produce facilities, services and programs which meet basic, long term needs of the people.









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The Platte Valley is the birthplace of the city of Denver. It is at the confluence of the South Platte River and Cherry Creek -- in the Platte Valley. Here it was that the first settlers pitched their tents and set up camps.

The railroads followed close on the heels of the first settlers, claiming all the lands in the immediate vicinity for their operations. They have held this land ever since. In the ensuing 100 years, the city has grown up around this tiny piece of "early beginning" land and now, in the fourth quarter of the 20th century, the railroads, by their location, have become an anachronism and an awkward presence in the very heart of a growing urban center.

The railroads would like to relocate to new yards and the city would like to return its most historic and strategic parcel of real property to public usage and service.

New urgency was added to the burning desire of the City of Denver to reclaim its birthplace--the Platte Valley--when a disastrous flood hit the central Platte Valley in 1965. Millions of dollars of damage was inflicted upon the Valley in the brief space of a few days. As a result of this tragedy, the city of Denver mounted a monumental civic effort, resulting in the publication of the study--In Response To The Flood. As a result of this study, the Chatfield Dam is under construction and plans for the Mt. Carbon Dam have been initiated. The Platte Valley is far along the path to becoming flood proof.

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### LOCATION

The Platte Valley lies in the geographical center of the Denver Metropolitan Area.

It is adjacent to Interstate 25, the principal northsouth freeway through the area. It is also in close proximity to Interstate 70 and 6th Avenue Freeway, the combination of which provide maximum regional access to the location.

The Platte Valley lies immediately west of the Denver central business district, which contains educational and cultural centers, as well as the commercial, financial and governmental centers for the region.

The Platte Valley is a natural river valley, having the confluence of the South Platte River and Cherry Creek lying within it. As the site of the original pioneer settlement, it is a place of historical significance.

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- Provide supporting facilities for the Auraria Higher Education Center.
- Iprove the urban design and visual environment of the Platte Valley, including natural elements, man-made elements, pedestrian circulation and transit systems.









### **ELEMENTS OF THE PLATTE VALLEY PLAN**

Natural Features

The river valley is a natural place to provide open space, park and recreation space for Denver's central area. The river can be restored to its natural state and historic importance as the natural element that prompted the original settlement. To mark this historic place, the Plan proposes a Centennial Park at the confluence of the South Platte River and Cherry Creek. The park will also allow for the restoration of Cherry Creek to its natural form and permit extension of its adjacent green space into the central business district.

### Open Space--Park

The concept of development of the Platte Valley is one of providing a major open space to balance the high intensity of use in the central business district and adjoining areas, of providing a transportation corridor and of restoring the natural river valley. At the same time, the concept for use of open space in the Valley is to provide for major recreation and for a tourist center. Such uses can be easily accommodated by the Valley and can be planned to fulfill functional and aesthetic needs, at the same time as they maintain river drainage requirements.

### West Bank

The river frontage on the west bank presents a very unique opportunity for the provision of transient accommodations and urban housing. Access use available from Interstate 25 and a service road can connect the linear, constricted strip along the west bank. Transient and urban housing can relate directly to the river with a series of walks, courts and overhanging balconies. The frontage is also enhanced by the Park, the open space and accompanying facilities of the Platte Valley, and the lakes and landscaping.

Presently, there are only 28 dwelling units and 7 businesses in this location. Almost half of the site is owned by the City. Redevelopment, therefore, can be readily accomplished with a minimum of relocation.

The location and activities of the Forney-Colorado Transportation Museum are consistent with the plans for the Platte Valley. The Museum and the redevelopment would mutually reinforce each other.

### Highlands and Bluffs

Across Interstate 25 to the west, the Plan envisions the restoration and redevelopment of the high bluffs area as a major multi-family residential area. Its heights, with its proximity to and magnificent view of the central business district, provide a unique opportunity to develop this area as the counterpoint to the central business district and as the major gateway to the Platte Valley and the core area. The area can accommodate a wide range of new and improved housing, including much needed low and moderate income family housing in a sound neighborhood.









### Westside

Along the southern perimeter of the Valley lies the Westside neighborhood, one of Denver's most historical and ethnically homogeneous housing and commercial districts. This neighborhood, within walking distance of the central business district, of the Denver convention and cultural center and of the Auraria Higher Educational Center enjoys perhaps the most strategic of all locations for housing and related commercial services. The Plan could produce a complete regeneration of this neighborhood in accordance with the ardent aspirations of its residents.

### Mile High Stadium

Mile High Stadium, west of Interstate 25 and in the southwest part of the Valley, will remain the Rocky Mountain region's principal focus for major sports and community events. Further, its function as a parking reservoir for the Valley and the central business district will be a reality when transit systems can link it with these parking users.

#### Central Business District

Major development envisioned for the central business district is reflected in this Plan to relate the inter-dependent elements that dictate planning and urban design. The major ties which may be eventuated concern circulation systems, pedestrian systems, malls, parkways,parking terminals and major public facilities. Skyline Urban Renewal Project, Skyline Park, Convention and Cultural Center, Government Center, Auraria Higher Education Center, Civic Center and Highlands and Westside housing proposals are significant related elements to the central business district.

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A major element in this Plan is the Auraria Center, presently being planned and carried out. This involves the development of a major urban higher education center which brings together Metropolitan State College, University of Colorado and Community College of Denver. This center will service 37,000 students and its impact upon the core area can be greated ameliorated by the Platte Valley Plan, which will provide open space, recreation facilities, parking, housing and access.

### Transportation

Major transportation elements are an important part of the Plan. In the future it is envisioned that the central business district will be served by a mass transit system and that a major corridor would be parallel to the existing main railroad line. A transportation terminal is envisioned for the core area in the vicinity of the existing railroad station. Bus systems, inter-city and intra-city, could come to the terminal. Helicopter service to and from Stapleton International Airport could be provided. Major auto parking facilities could also be provided to service the core area. From such a terminal, a people-mover system could distribute people to and from the downtown area.







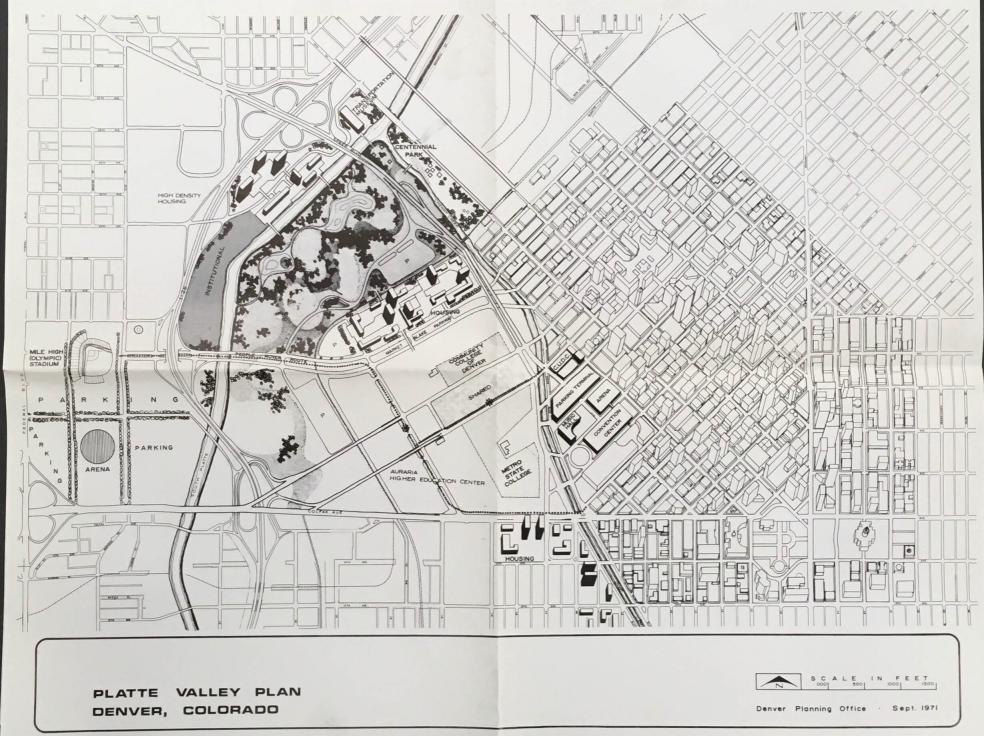


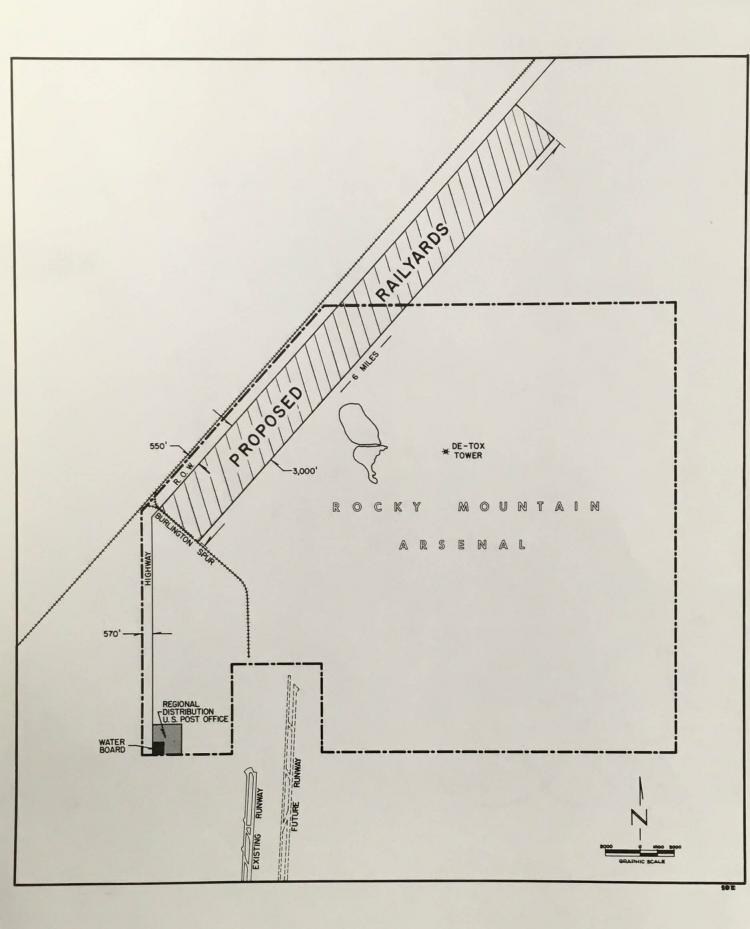
The Market-Blake Parkway through the Valley is an important new access that will provide much needed traffic carrying capacity to and from the core area. This could also serve as a ceremonial entranceway to the City. Existing major streets will be improved and replanned to fit the concepts in the Plan.

Other systems to move people to and from the core area and provide circulation within the Valley are currently the subject of a demonstration grant application by the Regional Transportation District. Such systems could tie together the parking reservoirs of Mile High Stadium, Platte Valley, Auraria Center and the central business district. By such systems, parking could be pooled so that at periods of maximum demand all of the above parking facilities could serve the point of maximum demand.

Railroad yards are shown as completely relocated in the Plan, therby permitting the realization of the complete redevelopment of the entire area. Mainline tracks would be consolidated and retained through the Valley to provide necessary rail service to and through the Valley.







United States of America



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A major element in this Plan is the Auraria Center, presently being planned and carried out. This involves the development of a major urban higher education center which brings together Metropolitan State College, University of Colorado and Community College of Denver. This center will service 37,000 students and its impact upon the core area can be greated ameliorated by the Platte Valley Plan, which will provide open space, recreation facilities, parking, housing and access.

### Transportation

Major transportation elements are an important part of the Plan. In the future it is envisioned that the central business district will be served by a mass transit system and that a major corridor would be parallel to the existing main railroad line. A transportation terminal is envisioned for the core area in the vicinity of the existing railroad station. Bus systems, inter-city and intra-city, could come to the terminal. Helicopter service to and from Stapleton International Airport could be provided. Major auto parking facilities could also be provided to service the core area. From such a terminal, a people-mover system could distribute people to and from the downtown area.







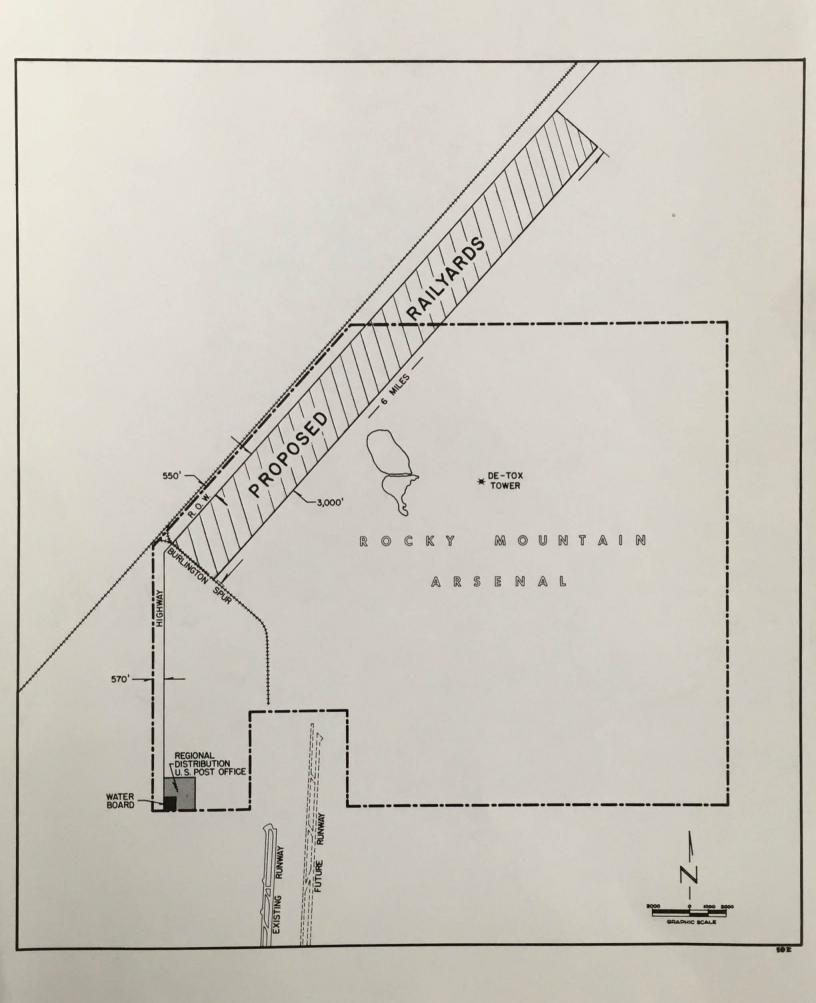


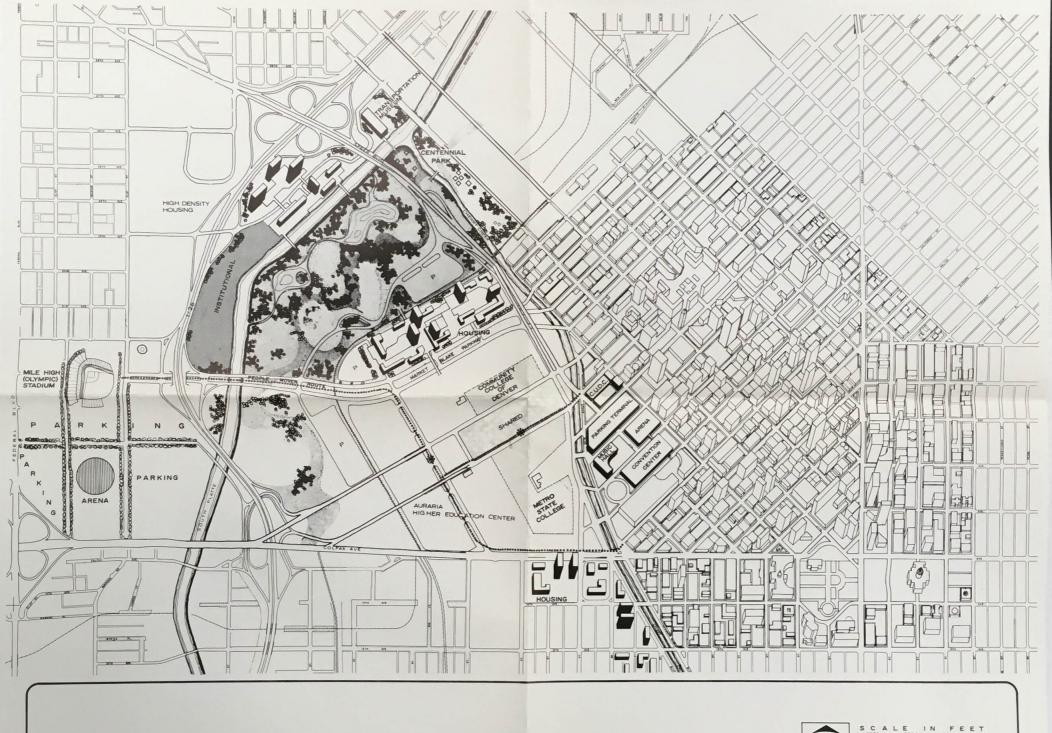
The Market-Blake Parkway through the Valley is an important new access that will provide much needed traffic carrying capacity to and from the core area. This could also serve as a ceremonial entranceway to the City. Existing major streets will be improved and replanned to fit the concepts in the Plan.

Other systems to move people to and from the core area and provide circulation within the Valley are currently the subject of a demonstration grant application by the Regional Transportation District. Such systems could tie together the parking reservoirs of Mile High Stadium, Platte Valley, Auraria Center and the central business district. By such systems, parking could be pooled so that at periods of maximum demand all of the above parking facilities could serve the point of maximum demand.

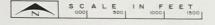
Railroad yards are shown as completely relocated in the Plan, therby permitting the realization of the complete redevelopment of the entire area. Mainline tracks would be consolidated and retained through the Valley to provide necessary rail service to and through the Valley.





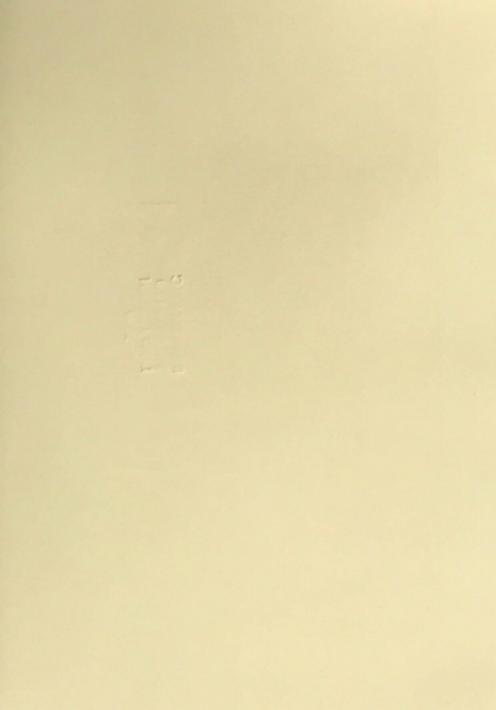


PLATTE VALLEY PLAN DENVER, COLORADO

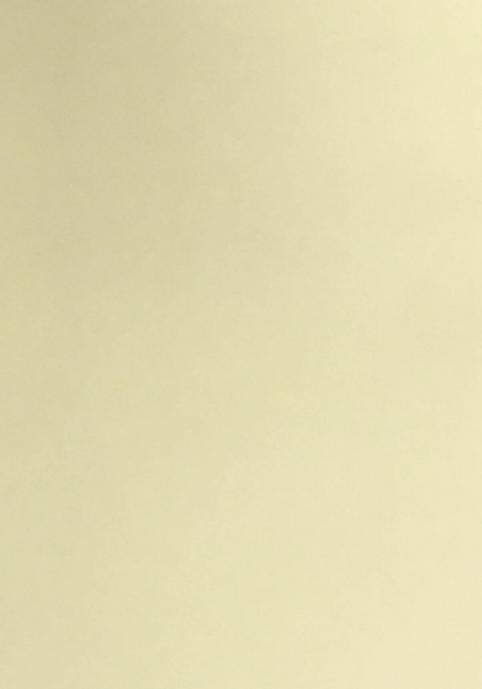


Denver Planning Office · Sept. 1971

Plate Vally Plano File



Coinage Bequienents Strage





### DEPARTMENT OF THE TREASURY WASHINGTON, D.C. 20220

OFFICE OF DIRECTOR OF THE MINT

July 15, 1975

Mr. Kenneth McLean
Director of Staffing
Committee on Banking, Housing
and Urban Affairs
United States Senate
Washington, D. C. 20510

Dear Mr. McLean:

As requested during our meeting with Senator Proxmire, enclosed you will find a brief narrative description of the Mint's long range coinage demand forecast and comments relating the projected demand to the need for a new Denver Mint.

I've also included our response to GAO on the merits of retaining the strip manufacturing capabilities at the Philadelphia Mint. Included are recent production costs which compare favorably with the prices of strip purchased from commercial sources. It should be noted, however, that strip production capability has no bearing on the pending legislation, which would authorize funds only for the administrative and coin producing facilities of the new Mint.

To fully meet the projected coinage requirements, it is essential that the penver Mint be replaced with a new and modern facility. If you like, we would be pleased to meet with you again after you have had an opportunity to review the enclosed material.

Sincerely,

Mary Brooks

Director of the Mint

Enclosures



#### Long-Range Forecasting of Coin Demand

Direct correlation of coin demand with time has proven to be as accurate for long-range forecasting as any other method. This conclusion was recently verified by multiple and simple regression analyses between demand and several economic variables such as sales tax revenues, retail sales of non-durable goods and number of new banks and branches. Other variables such as GNP and personal income correlate strongly with both retail sales and sales tax revenues and their inclusion in the study would have been redundant. It was found that none of the aforementioned economic variables offer a correlation advantage over time. Furthermore, each is in itself difficult to forecast accurately.

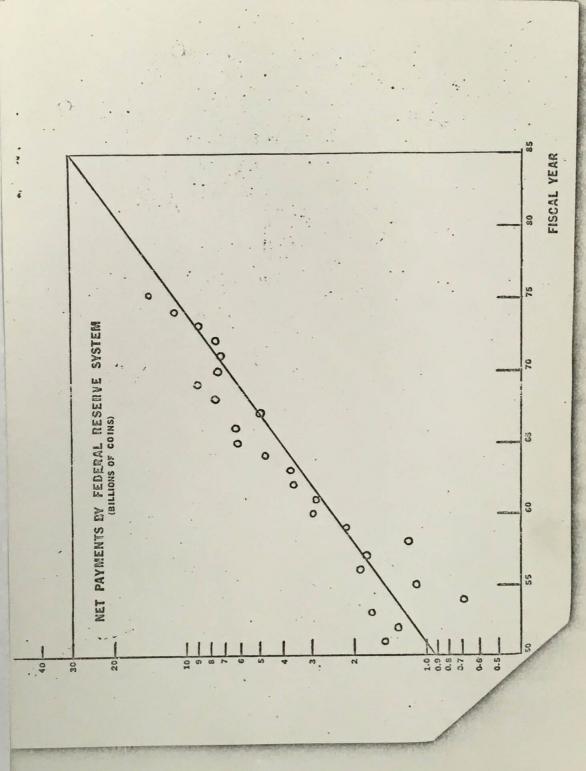
The attached figure illustrates an annual growth rate of 10.2% between FRB net coin payments and time. The large increase in checking account and credit card usage in recent years has had no discernible effect on demand growth. One major perturbation in demand occurred in the late 1960's when silver dimes and quarters were withdrawn from circulation (by both the public and the Treasury Department) and replaced by the copper alloy clad coins. Hoarding of cents caused by the high price of copper resulted in unusually high demand in fiscal years 1974 and 1975. Interest in the new bicentennial coins may raise demand above the forecasted levels in fiscal years 1976 and 1977.

Total coin demand extrapolates to 30 billion coins in 1985 and in excess of 40 billion coins in 1990.

#### Applicability of Demand Forecast to Mint Expansion Plans

The Mint's production capacity is gradually being increased within its existing facilities to meet the projected demand of 18 billion coins in 1980. It is essential that a new Denver Mint be constructed to meet coin demand in the 1980's. The new facility will initially add 4.5 billion pieces to capacity for a total of more than 22 billion. When fully equipped the new Denver Mint will have a capability of producing 16 billion coins for a Mint total of 27 billion. Furthermore, the Denver Pint will be designed and constructed so that the blanking through coining areas can be expanded to yield a capacity of 28 billion coins for a total Mint capacity of 40 billion.

Additionally, it must be recognized that the present Denver Mint is 70 years old and structural limitations relating to floor loads and work flow severely restrict the development of efficient production operations. In the process of designing, constructing and equipping the new Mint, it is planned that the result will be the most modern, efficient coin manufacturing plant feasible, using proved technology, equipment and industrial processes.



It is considered mandatory that the Mint retain in-house strip production capability for all denominations for the following reasons:

- A. The commercial suppliers of strip are unwilling or unable to devote that increment of their production facilities to totally support the needs of the Mint. This is particularly true in the case of clad strip that is used to produce 10¢, 25¢, 50¢ and \$1 coins. The Mint is constrained to a single source of clad strip and this source is unable to meet constantly increasing demand. A substantial reduction in the receipt of clad strip from the supplier would seriously jeopardize the production of clad coins.
- B. Prices charged by commercial strip manufacturing firms are subject to influence by in-house strip capability.
- C. If completely dependent on commercially produced strip, the Mint would lose flexibility in production because of the inherent long-lead time associated with procurement.
- D. Possibilities of strikes, natural calamities or changes in other commercial product demands (which are more profitable) could affect the suppliers' capacity or desire to provide strip at a reasonable price and in a timely manner, or to provide it at all. Difficulty has been experienced in receiving commercial strip in the past. Additionally, commercially supplied strip has not always been of acceptable quality, resulting in production delays.
- E. The Mint should have an in-house capability to produce a minimum of 50 percent of the strip required for coinage. With this capability it would be able to produce sufficient strip to meet essential coinage demand in the event of strikes or other external events that would interrupt the receipt of coinage strip. This will insure the performance of the Mint's mission to produce coins required to support the commercial activities of the United States.

Strip production costs now compare favorably with the cost of purchased strip as shown in the following table:

	1st 11 mos. FY 1975 Marginal Cost of Production	Average Purchase Price
Gilding Metal (1¢)	12 cents/1b.	14 cents/lb.
Cupro-Nickel (5¢) Clad (10¢, 25¢, 50¢, \$1)	16 31	26

Clad strip manufacturing cost was 39 cents/1b. in Fiscal Year 1974. We increased clad strip production from 2.4 million 1bs. in Fiscal Year 1974 to 9.1 million 1bs. in Fiscal Year 1975. The trend of decreasing clad strip manufacturing cost is expected to continue in Fiscal Year 1976 as productivity continues to improve in this area.

July 27, 1973

To: Mr. Frank Rhea, Facilities Project Manager

From: Henry Riddick, Head, Cash Division

Subj: Estimated coin storage space needed in the NEW MINT.

This estimate is for a 45-day production period, based on producing 15.75 billion coins per year.

Other factors: 237 working days (260 less 8 paid holidays and a \_5-day Settlement shut-down). Use of Fed. Res. Bank skids, placed three (3) night.

Total square feet called for includes no provision for aisles and access routes to coin, nor for denominational and yearly segregation. However, I have allowed 10 sq. ft. per skid, whereas the actual square foltage of a skid is 7.23, so some leeway is inherent. (Actual skid size: 40"x26"x30" allow,

42 x 28 8.2 my 2t.

#### Formulas used:

CENTS (5000 per bag, 350,000 per skid, 70 bags per skid)

NICKELS (4000 per bag, 240,000 per skid, 60 bags per skid)

(10000 per bag, 500,000 per skid, 50 bags per skid)

QUARTERS (4000 per bag, 200,000 per skid, 50 bags per skid)

HALVES (2000 per bag, 100,000 per skid, 50 bags per skid)

OOLLARS
(1000 per bag, 50,000 per skid, 50 bags per skid)

OTHER COIN (Counts are speculative)
(8000 per bag, 400,000 per skid, 50 bags per skid)

DENOM.	PIECES	BAGS	SKIDS	SQUARE FLIT
l¢ .	2,643,030,000	528,606	7,552	75,520
5¢	176,580,000	44,145	736	7,360
163	62,640,000	6,264	126	1,260
25¢	31,320,000	7,830	157	1,570
50¢	15,660,000	7,830	157	1,570
\$1	15,660,000	15,660	314	3,11,0
Other	45,540,000	5,692	114	1,110
	2,990,430,000	616,027	9,156	92,500

91,560 Square Feet divided by 3 (skids stacked 3 high) = 30,520 Sq. Ft.

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Construction moragement



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# (ACMIE BIJOU CLASSWORKS)

2128 15TH STREET DENVER, COLORADO 80202 (303) 825-0487

February 20, 1975

RECEIVED

FEB 25 1975

SUPERINTENDENT DENVER

Mr. Frank Ray
Denver Mint
Delaware and W. Colfax Ave.
Denver, Colo.

Dear Mr. Ray:

Acme-Bijou Glassworks is a custom design studio of stained and beveled glass whose work is beginning to achieve a level

of national prominence.

Our reputation is based on many successful coordinating efforts with architects and interior designers, on our excellent and never-overlooked attention to fine craftsmanship, on our blending of new techniques with an older architectural form, and on our unique and contemporary graphic design capabilities.

Thank you for giving me a few moments on the telephone the other day. Please glance through the enclosed material and then keep us on file until the plans are being drawn up for the new Mint. We would like to submit a proposal for the lobby and entrance area.

Michael D. Esta

Michael D. Eaton



Modern technology has, in effect, done away with use of lead cames as hand-blown glass is epoxy-bonded to plate glass. The effect, as in design (near right) by Peter Ostuni, executed by Rambusch Co., is subtle and soft, relying on abstract patterns of color for effectiveness.

Free-hanging stained glass panel, heralded by some as the way of the future for stained glass, is used purely as decorative accessory in Colorado's Greely National Bank (top). Crafted by Acme Bijou Glassworks, the panel, when viewed from surrounding balcony, creates the illusion above the trees of actual flight.

"Idflowers International Bar



#### Glass becoming scarce

Philas

Glass is priced according to color, with deep reds and blues topping the list. Some glass is becoming very hard to get at any price. The cost of both labor and materials is on the rise," says R.A. Manning, President, R.A. Manning Co., "with glass rising in price almost 10 percent per year. Delivery dates range from eight or nine months on hand-rolled glass imported from Belgium or Germany."

English glass is virtually impossible to import, and even translucent glass from Kokomo Glass Co. here in the states, is becoming scarce. Occasionally scrap glass, either pieces left over from panels, or scraps salvaged from old windows, are used.

The artist must remember that a stained glass window should not be "a picture made transparent, but a section of the wall made beautiful." The panel must take its direction from the architecture which gives it its purpose for existing.

In a space where illumination of dark interiors is necessary, figures on a light, almost transparent background should be used. If a figure is placed high in a clerestory, it must be

designed in broad, sweeping strokes, to be dentifiable from so great a distance. "The must first make a careful color study," go Bech Rambusch, President, Ramos, "so that the desired interior atreated. The fracturing of the en of the cames must be as to give proper scale

ance the style and

the architec-

THE BUSINESS MAGAZINE OF COMMERCIAL FURNISHINGS & INTERIOR ARCHITECTURE stain. of the a. any changes In addition to are structurally about 4 lb. per sq. 1. between 10 and 12 lb. per often reached weights of 20 ft., because of laminations of g

create certain color effects.) The window's wooden mullions, and . tural supports, embedded into the window frame, actually support the weight of the window. "Many people feel these structural necessities destroy the esthetics of a window," explains Millard, "but bars, reinforcement, and lead all contribute to the charm of the window.

#### Leave restoration to pro

Improper structuring of the panel will take its toll in time. Designs which are concentric in nature, forming a "bull's eye" pattern, will eventually project outward. Poorly supported

panels will sag, or even break, if moved for restoration or repair.

A large part of contract stained glass work is restoration. It is imperative to obtain the services of someone knowledgeable in the medium. Glass types must be matched exactly. A slight change in color pattern could destroy the over-all effect of the design.

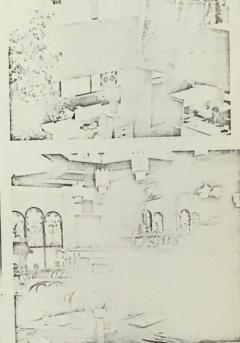
Texture, acquired over the years through weathering, is an irreplaceable quality in old stained glass. Restore this glass in the name of "prevention" and a depth of quality which only age can provide is sacrificed. Re-leading,

There are those who feel that leaded glass is compatible with modern architecture. led glass does not really harmonize with architecture or with architectural maintains Peter Fuller, General

> delicate, with a light airibreaks with the solid Architectural Arts hough the win-

faceted Jo-de-. the eted to

vy sections. They are, of course, thi. But these sections function as reight-bearing material, and as such, can be billed by architects as essential parts of the building,



CONTRACT

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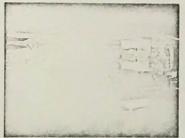


Among many businesses turning to the use of stained glass is Pilliod's Cabinet Company in the World Trade Center, Dallas. Wanting to add a look of warmth in their showroom, they commissioned 1912 Lamp Company. to design their door and side windows.

Demonstrative of the semi-restoration work popular in contract stained glass is the use by the Olla Podrida craftsman's mall of this antique semi-circular glass window with the modern addition of their name.







lead and copper wire for the detail work

A portion of the Hummingbird window, part of the Americas in Colorado Exhibit of artists and craftsmen works, is among the collection of stained glass art by Acme Bijou. Fab-ricated with authentic Tittany glass, the design includes double drilled jeweis and beveled glass.

And storied windows richly dight Casting a dim religious light. John Milton

It has been said that true beauty will always remain - that it will transcend time. Such is the case of the stained glass window. The translucent beauty of the mosaic pattern produced by sun fingering its way through a stained glass window is unsurpassed. It presents itself as a many faceted personality producing a quiet feeling of serenity. Perhaps this awesome sight and feeling is a part of the reason this ancient hand-crafted art form is currently enjoying a renaissance of popularity.

Paul Fihn of Acme Bijou Glassworks, a

multi-directional stained glass studio in Denver, Colorado, attributes this renai "the wave of humanism apparent in ou - whereas rights of groups bega rights of the individual which brought about self interest and expression. From this we have seen the return of the craftsman and the recognition and appreciation that he deserves. 'More is better' is no longer the prevailing attitude of the people. They want and recognize quality

The current renaissance has overtones of a similar one in nineteenth century America.

The move at that time, by stained glass craftsmen who had migrated to America, was seen as a move against industrialization.

The quality and timelessness of stained glass work produced then and now are evidenced in the fact that the craft itself has virtually remained unaltered over the years since its invention. The steps and methods used in production, which include cutting the glass by means of 'cartoon' drawings and soldering lead between the pieces, achieved such excellence in stained glass' early stages that they have been unable to be improved

In beginning a stained glass work, John Kebrle, who has a custom glass studio in Dallas, believes the hardest point is "determining what style the glass will take. You must take into account the surroundings and whoever will be viewing the glass. Any piece of art — regardless of what it is — has to have something that appeals to the viewer.

That appeal was one of the dominant factors for the early religious use of stained glass. Many glass studios were started by the churches, thus much of the glass work done was of this type. The traditional, old glass has remained, along with new glass.

The two main suppliers of new, domestic glass are Blenko and Kokomo Opalescent with Germany, England, France and Belgium heading the list of foreign suppliers. As a rule, domestic glass is most often used because of the price of importing foreign glass. The most common type of glass is antique glass, colored by means of metal oxides. Both old and new glass are being used in a variety of ways and areas. Two such areas involve the move of stained glass into contract and gift use.

In contract work, a number of restaurants are turning to stained glass decor to further establish the mood and period theme of the establishment. Many, such as the Public Eye in Memphis, use old glass. Dick Fisher, owner of the restaurant, expressed his reasoning for using stained glass as one of both aesthetic and useful purposes. "We wanted to add to the Victorian atmosphere and, at the same time, enclose the kitchen and separate it from the dining area."

Other establishments such as the Randy Tar in Dallas, personalize the area by the use



Guild Arts & Crafts, Inc. is one of several gift firms adding stained glass to their lines. Part of their Stained Glass America Collection, small sculptures designed in series, is this Animals of North America group.

of new stained glass, designed to their specifications.

The addition of stained glass is also seeing popularity in shopping areas such as the Olla Podrida, a craftsman's mall in Dallas. The developer of the mall acquired an unusual, semi-circular window for the mall's entrance, originally housed in a Jewish temple, and wanted to retain its beauty yet tie it in with the mall. The addition of the Olla Podrida letters to be inset into the

window was commissioned and the window has since become a "calling card" for the mall. This type of semi-restoration work is popular in contract work. And businesses such as Pilliod's Cabinet Company's showroom in the Dallas Market Center's World Trade Center are incorporating stained glass in line with the trend.

An indication of the popularity of stained glass is its adoption by the gift area which has enjoyed a growing business in glass items ranging from Christmas tree ornaments to jewelry boxes.

One gift firm, Guild Arts and Crafts, Inc., became interested in developing a process for manufacturing a stained glass line in which metal parts would not be restricted to the traditional came and lead metal characteristics. Wanting to adapt the metal according to the specific design character of each craft grouping, they developed hand-cut stained glass figures.

Robert Schetter for Stained Glass Originals



An increasing number of restaurants are using period decor, complimented by the use of stained glass. Here, a Victorian-styled restaurant, The Public Eye, in Memphis, reclaimed old church windows to separate their kitchen and dining areas.



The popular reproduction of the Tiffany lamp is carried over into these table lamps by Lamp Fashion.

of Aspen has combined the use of naturally preserved dried flowers with stained glass to produce hanging, decorative windows of varied sizes.

The Val line of Tucson has presented a variety of hand-crafted items comprised of hanging ornaments incorporating leaded glass and stationary sculptures. All are

designed by the firm's head, Bill Valentien, a former architect.

Art-related backgrounds such as Mr. Valentien's, are common among studio and gift designers. Artists in increasing numbers are being commissioned by studios to do stained glass works.

Possibly a carryover from this art influence is the use of pieces done purely as an art form — a fairly unexplored area of stained glass. A front runner in this style of work is Acme Bijou's designer lim Black, who does pieces specifically for art shows and galleries. Many are fabricated with authentic Tiffany glass, such as the firm's Hummingbird and Dragontly hanging window displays. Other pieces are used in light boxes, one of many unusual light sources the studio is exploring along with three-dimensional effects and the utilization of sandblast etching into designs.

The potentialities for future stained glass work, if one can judge by the present, are limitless. Studio Stained Glass, a retail and wholesale glass studio in Kokomo, Indiana, is one of a growing number of studios which does not only custom work but also conducts lessons for the hobbiest. Peggy Ragland, owner and manager of the studio, believes that "the stained glass market is still untapped in many areas. So it is definitely growing. If the past is any indication, I'd look for the trend to remain for 10 to 30 years."

Zane Farmer of Turn of the Centuries Antiques in Dallas, believes that, due to the current renaissance of glass, true antique stained glass will disappear to the point of becoming obsolete in a matter of years. This will undoubtedly have an effect on the scope of production of new glass.

As for the present, Jack Kramer, president of Guild Arts and Crafts, Inc., states: "We feel that genuine stained glass giftware will



Windows of stained glass in churches and temples is a tradition. John Kebrle designed this wondow used at a church in Dallas, one of many created by his studio.

remain important in the market place because the natural ingredient of variations in glass characteristics..." plus varied light sources"... combine to make an otherwise static craft object into a vital living creation."

The attitude of Acme Bijou, of linking the traditional with the technological and translating something old into something new, is one seen in many such objects of beauty—insuring their tuture popularity for years to come.

### UNITED STATES OF AMERICA GENERAL SERVICES ADMINISTRATION

September 14, 1973

Region 8
Denver Federal Center
Denver, Colorado 80225



Mr. Frank Rhea Denver Mint 320 West Colfax Denver, CO 80204

Dear Mr. Rhea:

Enclosed for your information and files is a copy of our September 14, 1973 Invitation Notice for Construction Management Services which is being sent this date to approximately 800 construction management firms nationwide. This notice establishes September 24, 1973 as a deadline for receipt of request for preliminary proposals (without prices) by this office. We propose to issue the preliminary proposals on or by September 26, 1973 and have established 1:30 p.m. on October 16, 1973 as a deadline for receipt by GSA of the preliminary proposals from prospective construction managers.

Our schedule of September 10, 1973 for the Construction Manager Contract Negotiations established October 17, 18 and 19, 1973 as the review period of the preliminary proposals by the Construction Manager Selection Review Panel. It is requested you be available to participate in the Construction Manager review on the above dates.

Enclosed for your information is copy of the September 10, 1973 Construction Manager Contract Negotiation schedules which reflects our desire to have a Construction Manager under contract by mid-November of this year.

I trust this meets with your approval.

Sincerely,

DAVID L. GESS Project Director New Denver Mint

Enclosures

Project No. 72-124 New Denver Mint Denver, Colorado

Proposed Schedule for Construction Manager Contract Negotiations

1. Memo to Commissioner, PBS, requesting use of Construction Manager Services. Date April 11, 1972

- Receipt of authority from Commissioner to use CM services.
   (Tentative approval from Acting PBS P received.)
   Date October 25, 1972
- 3. Signing of Memorandum of Understanding and Agreement by Bureau of the Mint.

  Date September 10, 1973 (estimated)
  - 4. Complete Findings and Determination for CM services and approval to use CM concept (by Central Office.)

    Date September 12, 1973 (estimated)
  - Prepare Invitation Notice for Construction Manager Services (2 days).
     Date September 11 and 12, 1973
  - 6. Publish CM Invitation Notice in Commerce Daily Journal, etc. (This activity not necessary per Alex Papademetriou.)
  - 7. Send Invitation Notices to all CM firms on GSA list. Date September 14, 1973
  - 8. Deadline for receipt of request from interested CM's. Date September 24, 1973

- 9. Send request for Preliminary proposal (without prices) to interested firms (21 days to reply). (Prepare 50 sets). Date September 26, 1973
- 10. Deadline for receipt of Preliminary Proposals (without prices). Date 1:30 p.m., October 16, 1973
- 11. Review of Preliminary Proposals by CM selection review panel Date October 17, 18 and 19, 1973
- 11. (a) Interview selected CM firms. Date October 24, 25 and 26, 1973
- 12. Send Invitation for price proposal to selected firms, CM firms (10 days to reply).

  Date October 26, 1973
- 13. Deadline for receipt of price proposals. Date 1:30 p.m., November 2, 1973
- 14. Review of price proposals by Project Director. Date November 3, 1973
- 15. Forward Selection Panel's recommendations to the Central Office for final approval of the Administrator.

  Date November 3, 1973
- 16. Selection of the Construction Manager by the Administrator. Date  $\underline{\text{November }13,\ 1973}$
- 17. Execute CM contract. Date November 15, 1973
- 18. Inform unsuccessful offerors by letter. Date November 15, 1973

#### General Services Administration Public Buildings Service

#### Invitation Notice for Construction Management Services

The General Services Administration seeks construction management services for the proposed new Denver Mint, Denver, Colorado to provide approximately 400,000 gross square feet within an estimated cost range between \$40 and \$50 million, including procurement and installation of metal processing equipment. Design and construction will be concurrently phased with separate construction contracts awarded as segments of the design are completed by the architectengineer.

Consideration will be given to firms or joint ventures generally meeting the following requirements:

1. Experience as a Construction Manager or potential competence to perform construction management services; 2. Shall be financially able to provide the services required by the Government; 3. Shall have competence in architectural, civil, mechanical, electrical and structural engineering; construction estimating; cost accounting and control; project management; contract negotiation and administration; construction superintendence and inspection; and other related fields; 4. Shall have constructed buildings in the general geographic area of this project, or have good recent knowledge of local conditions in the project area, or can retain others with such knowledge; 5. Be able to provide professionally qualified personnel to staff the project; 6. Have a good professional and business reputation, and an on-time performance record.

Prospective construction management firms or joint ventures who are interested in the project are invited, prior to September 24, 1973, to ask for Request for Preliminary Proposals (without prices) which will be issued by the office below on or by September 26, 1973. Preliminary Proposals (without prices) will be received until 1:30 p.m. on October 16, 1973 at GSA, Region 8 Business Service Center, and then evaluated on the basis of the requirements and criteria contained in the Request for Preliminary Proposals. Subsequent to evaluation of

Preliminary Proposals, the Government may hold a discussion with each of the offerers who are deemed to be within a competitive range based on evaluation of the written Preliminary Proposal. The discussion may serve two purposes: (1) It will enable the offerer to discuss his written submission (Preliminary Proposal) for purposes of clarification, explanation, rationale and demonstration of his understanding of the contract requirements. The discussion will be the basis for reevaluation of the Preliminary Proposal by the Government. (2) The discussion may also serve as a negotiation. Should the offerer elect to modify his proposal, as a result of the discussion, confirmation of the modification should be submitted in writing before a closing date established by the Government. Invitation for Price Proposals will be requested from only those firms or joint ventures whose Preliminary Proposals have been determined by GSA as being most favorable. Only Price Proposals specifically requested by the Government will be considered.

Requests for Preliminary Proposals shall be sent to:

General Services Administration, Region 8 Public Buildings Service Design and Construction Division Building 41 Denver Federal Center Denver, Colorado 80225

Attention: Mr. David L. Gess Project Director

Telephone (303) 234-2645



#### THE DEPARTMENT OF THE TREASURY

UNITED STATES MINT
DENVER, COLO. 80204

June 28, 1972

Mr. Robert L. Shaw Randolph Engineering Company Pittsburgh, Pennsylvania 15241

Dear Mr. Shaw:

This is in response to your letter to the Treasury Department of June 15, 1972, regarding the construction of a new U. S. Mint in Denver, Colorado.

The decision has been made by the Bureau of the Mint and the General Services Administration that the turn-key method will not be used in constructing the new mint. Our design and construction planning is based on the following outline:

- a. Industrial process design and buildings/site design will be accomplished by an architect-engineer, with design expected to commence about 1 September 1972. Architect-Engineer firms for this purpose have been interviewed by GSA and the Bureau of the Mint and A/E selection is imminent.
- b. The Bureau of the Mint will procure major process equipment (melting and casting, ingot hot rolling, strip preparation, blanking, coining, etc.) by the competitive bid procedure and furnish this equipment to the constructor/installer for installation. We expect to award, in September of 1973, the major portion of these procurement contracts.
- c. A site preparation, buildings construction, equipment installation contract will be awarded about September 1984.
- d. Some process equipment, operating tools and supplies and furniture will be relocated from the present mint. This will be accomplished by Bureau of the Mint personnel.

In addition to the above, the General Services Administration plans to contract with a Construction Management firm to provide the following services: detailed review of designs and bid documents prepared by the A/E, primarily related to cost control, construction feasibility and value engineering; factory inspection

of process equipment items procured by the Bureau of the Mint; shop drawings, samples submittals and testing requirements review and recommendations to the Contracting Officer; and construction/installation inspection. It is expected that this Construction Management contract will be awarded in August 1973.

I trust that the above provides the information you requested regarding the new mint. If there is any further information you would like to have, please contact me at the address listed below.

Sincerely,

Frank W. Rhea Facilities Project Manager Bureau of the Mint Denver Mint 320 West Colfax Avenue Denver, Colorado 80204

FWR:edg

cc: Director of the Mint
Asst. Director for Public Services
Superintendent
Deputy Superintendent



June 15, 1972

The U. S. Treasury Department Pennsylvania Avenue at 15th Street, N.W. Washington, D. C.

Dear Sir:

It has recently come to our attention that The U. S. Treasury Department and the General Services Administration will build a new U. S. Mint on a 33-acre tract on the west bank of the S. Platte River, between the Cresent yards and the Speer Blvd. overpass at Denver, Colorado.

The intent of this letter is to give you some background about our company and to convey to you our interest in the installation and/or relocation of machinery and equipment for this facility.

For more than twenty years we have been of service to industries throughout the United States. We have been retained to perform turn-key installations or relocations which include the scheduling, planning, electrical, mechanical, rigging, millwrighting, transportation, and all other work and services required for a completed job.

You can draw on our many years of experience in this specialized field by retaining us to engineer, manage and perform your project from start to finish. This will allow your key management group to continue in their day to day business roles.

Please advise us of the status of this project and as to whom we should contact having the responsibility for this portion of the work.

Your early response will be greatly appreciated.

Thank you for your time and consideration.

Sincerely yours

Robert L. Shaw

## THE DEPARTMENT OF THE TREASURY BUREAU OF THE MINT

#### Route Slip

TO:

Mrs. Brooks

Mr. MacDonald

Mr. Ferguson

Mr. McGee

Mr. Ambrose

Mr. Cahoon

Mr. Carwile

| Dr. Goldman

Files

DATE:

7/3/

27 - recovered into be sent to Front Plan

FOR APPROPRIATE ACTION

#### VINCENT G. KLING & PARTNERS

VINCENT G. KLING, FAIA MANAGING PARTNER

Keading The enclosed article from fiterias maga -Zene gave me a great deal Joy looking it over too. On the subject of enlerans, I am happy to announce a new Luisian, Lling-/- Interiors and a new devector, Don Freebel. I am also sendeng copies of are expellent antiele on "management of the Planning process" by one of our partners, Jack Rutkowski,

the site or +1

## PROCESS AND PROJECT MANAGEMENT

# Management of planning process

Management of planning process entails budgets, allocations, and competition for space

John Rutkowski

braith once remarked that a large government agency somehow added up to "less than the sum of its parts." Unless a hospital board or a building committee strives for humane as well as economical programming of space in a new building or in an addition to an existing structure, that hospital will add up to "less than the sum of its parts."

In calling for more humanity in hospitals, I may seem to be presumptuous, for as an architect I have observed the humaneness and dedication of most persons who work in and for these institutions, But my perspective is different. When I say humanity I mean humane spaces.

Humane spaces connotes various meanings—support facilities, parasitic space, the space between departments, passive space, storage space, elbow room, the difference between gross square footage

and net square footage, "unnecessary space." To the hospital architect, however, these spaces make all hospitals—small community hospitals and metropolitan medical centers—add up to the sum of their parts and more.

Spaces that serve no purpose in hospitals never have been justifiable, and certainly in this day of constricted federal funding and reduced private support they are even less justifiable. In order to guard against programming space for its own sake anywhere in a hospital, the process of programming must be prudently managed and the competition for space, tightly controlled.

However, I do submit that a judicious measure of humane space, today more than ever before, is the proper concern of a hospital's policy-making board and administration. Because all of us not only want but need space in hospitals to stand, sit, eat, walk,

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Journal of the American Hospital Association
Volume 46
February 1, 1972
Printed in U.S.A.

pray, rest and wait, programming such space serves justifiable purposes. In fact, humane space deserves more consideration in the programming process than it often gets.

#### Architects espouse humane design

If an architectural firm with experience in hospital design does not champion the cause of humane spaces, it is unlikely that anyone will. For of all the individuals involved in the programming process (including the hospital consultant if one has been retained), only the architect is trained and encouraged to envisage the completed building in its human as well as its functional and economic dimensions.

For this reason, a hospital board or building committee is well advised to choose its architect in the earliest stages, before programming begins. After all, the first step in effective management of the programming process is to make sure that the process itself is based upon sound premises. The most comprehensive and economical hospital programs are conceived within the context of master plans that anticipate future relationships as well as define current needs.

When viewed in this larger context, there is a direct relationship between the scope of the programming process and the length of time that the completed facility will continue to deliver the high degree of operating efficiency it initially achieves. The hospital that is building for the future—to do otherwise is to deny there will be a future—should look beyond immediate needs and capabilities.

It's important to be a dreamer and to look ahead to at least the second stage of the programming process at the very outset. The architect is responsible for process management at this point. He manages the dreaming, asks questions that open new lines of inquiry, and seeks to sharpen the focus of other participants in the endeavor. For example, the institution should compare its view of the future with the view held by any health care planning agencies in the area.

#### Collecting program information

Gathering program information from various departments of the hospital proceeds along similar lines. In this instance, however, process management is best shared by the architect and a liaison for the owner. Departmental needs for space, as perceived by the

heads of departments, can be submitted in writing or obtained in personal interviews.

Department heads should be asked to write something down and thus preclude vague or hurriedly stated requests. The architect then conducts personal interviews during which he often seeks to clarify information that has been submitted. A face-to-face conversation with the appropriate department head serves this purpose best. Furthermore, it provides the architect an opportunity to temper the optimism or the pessimism that users of hospital space often express. In this collective client relationship, the architect has a responsibility to help each department head relate his own special needs to those of the institution and the community.

For example, if the head of an emergency department is so beleaguered that he optimistically believes one additional room would be a real godsend, the architect must stretch that man's thinking. Sometimes, however, the head of an emergency department may insist that he can survive only with new spaces that the architect knows are beyond the budget. In this case, process management is well served if the architect can modify the man's pessimism by discussing realistic and feasible improvements that responses to the following questions suggest. Does the emergency department serve an urban or a rural area? If rural, is there an interstate highway nearby? How much routine treatment will there be of mobile suburbanites who don't have family

physicia cause peak summer loa percentage of emergency can ires minor surgery, major surg radiol\_ ogy services? Do you ly need more work space or only a place to keep waiting patients out from underfoot? If the budget were unlimited, which it is not, what would give you an ideal setup here? What new equipment do you foresee?

Searching for the concepts and conditions that will have a bearing on design, the architect repeats this process with all department heads. At this juncture, he is less interested in solving problems than in collecting problems that exist. In the interests of a humane and efficient building, he also is probing for problems that remain undetected or undefined. Whatever the outlook of each department head, the architect who is sensitive to the interrelationship of hospitals to communities and departments to departments, considers these conversations indispensable.

In practice as in theory, space programming should be based upon need; it should not be based upon such factors as the seniority of the personnel involved. This fact of good process management and the inevitable proposals to deviate from it constantly must be weighed by the architect and the owner's liaison man. The ultimate cost of a building reflects the owner's program. The program reflects needs that must be neither understated nor overestimated.

#### Evaluating the information

The architect now must organize and analyze the mass of facts, opinions, hopes, dreams, complaints, and ideas that he has collected. As he separates basic information from minor detail, his responsibility to the institution as a whole and his understanding of budget restraints come into play. He applies past experience to new situations. Implications of form may be emerging from the compiled information, but because an architect is assessing the data a design concept cannot "force itself" spontaneously into the process and dictate a building incom-

The Author -



John Rutkowski, AIA, is a partner and studio director in the Philadelphia firm of Vincent G. Kling & Partners, planners, architects and engineers. Rutkowski has a bachelor's degree in architecture from the University of Pennsylvania and has had extensive experience in the design and construction of health care and medical research facilities.

patible with the site or the budget.

After he has compiled the net space needs of the departments that will occupy the new building or addition, the architect discusses his findings with the client liaison. Together they equate these space needs with the budget and with the institution's master plan. They resolve disparities between the stated functional needs of departments and the practical limits of square footage that can be afforded.

Time spent in preliminary longrange thinking begins to pay off here. The client who has been encouraged to think in terms more comprehensive than "cost per bed" now can weigh the institution's alternatives more quickly and with greater confidence. For example, he understands that the cost of a 300-bed "chassis" (the basic facility needed to serve 300 beds) should be applied not only to the 100 beds initially being built but also to future beds that will cost relatively less because the facility to serve them actually will exist.

To the net square footage in this evolving program the architect adds a "planning factor" for nontechnical, humane spaces (corridors, mechanical areas, elevators, toilets, attractive eating facilities, an area adjacent to the lobby for wheelchairs, and delivered flowers). At this point, process management primarily is a client responsibility. The architect serves as advocate, counting fractional percentages in his effort to defend a measure of humane space by decrying the same economies he espoused during his talks with department heads.

Net square footage plus planning factor equals gross square footage. Drawing upon prior experience with hospital space programming, the architect obtains his best possible estimate of the overall cost per square foot. With the assistance of the client liaison, he now is ready to revisit the department heads and to discuss departmental function in terms of square footage allocations. As in the earlier stage when he was collecting data on functions and needs, the architect shares his per-

spective with department heads. All clients have initial and understandable notions, based upon past experience, of what they need. Some wish to recreate their old spaces in the new building because they are sure nothing could be better. Others are so uphappy with their exisiting spaces that they insist upon totally different arrangements even though (from all the architect can determine) minor adjustments in space and equipment would make the same square footage work significantly better.

With the help of each department head, the architect considers the deployment of department personnel, within departmental spaces and elsewhere in the hospital. He explains how an existing building may influence the arrangement of spaces in a projected addition. He introduces the recurrent dimensions of economical, modular design. He helps the department to think in three dimensions. For example, in a modern elevator one sometimes can get to rooms on different floors in less time than it takes to reach rooms located on the same floor.

As the process continues, priorities for adjacent spaces emerge: the emergency department should be near surgery, surgery should be near central sterile supply, the dietary department should be near the kitchen, and nurses' stations should be near patient rooms. In fact, so many desirable relationships are listed that the architect, translating these conflicting priorities into form, can theorize the ideal hospital as a perfect sphere, with each department at the center.

Efficient process management, however, calls for timely establishment of "optimum adjacencies." These can be hard choices that involve more than the obviously crucial relationships between surgery, radiology, and intensive care. For example, if the new building is to stand on a two-sided city lot hemmed in by existing structures, should the emergency entrance be adjacent to the service entrance or to the visitors' entrance? Neither is desirable, but

site limitations dictate a choice.

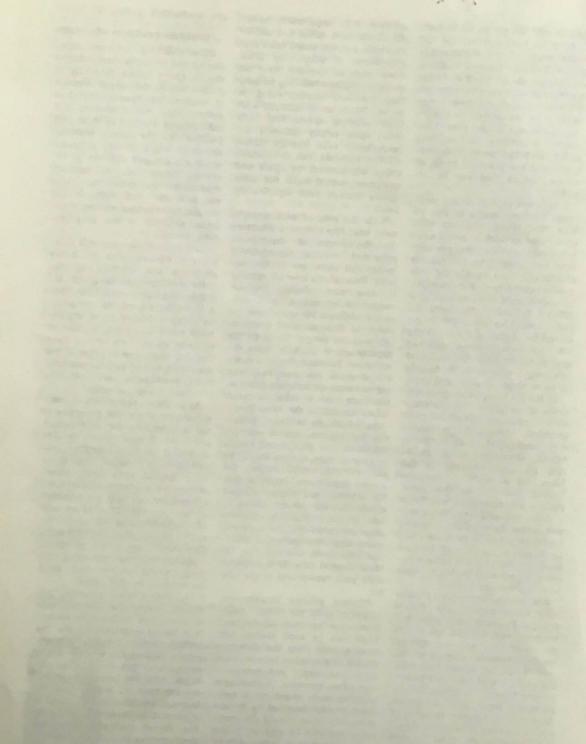
#### Establishing optimum adjacencies

In establishing optimum adjacencies and trying to create shared spaces, the architect generally is guided by the functional division of hospitals into spaces devoted to patient care, administration and public usage, medical services, and parking. To the extent possible, spaces in which similar activities occur are grouped together to facilitate future changes. Because medical services entail the greatest scientific and technological change, these spaces warrant maximum scrutiny in the programming process.

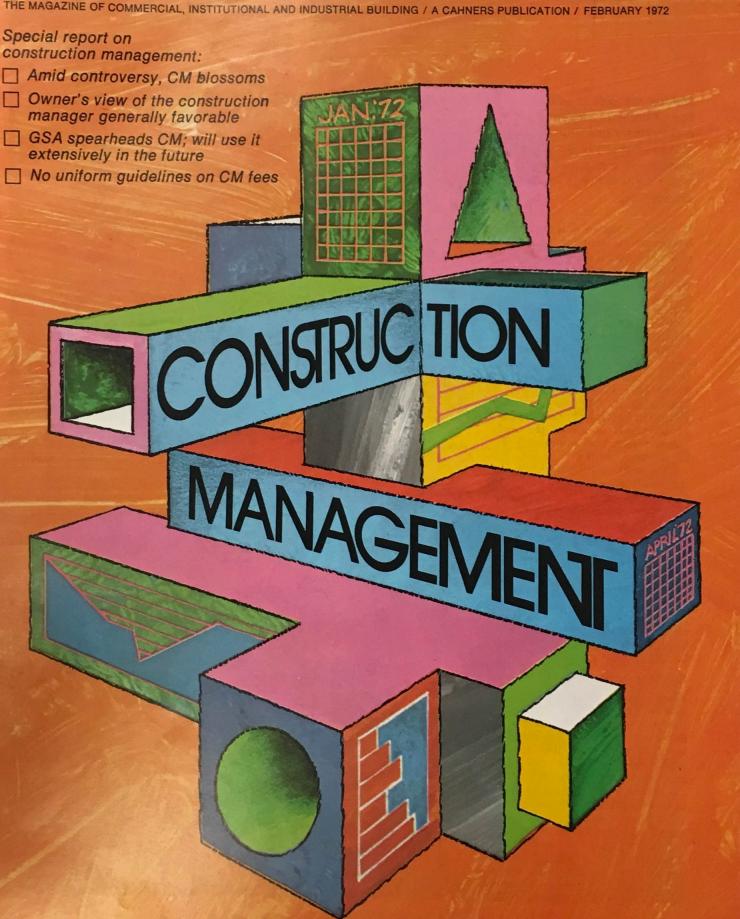
At this point, the use of a computer is advantageous. It swiftly generates and displays all the space combinations that the architect and client should consider. A computer's apparent "objectivity" may influence some department heads to accept the reality of finite space more readily than the architect's presentation. From the standpoint of process management, a computer saves valuable time and therefore money.

As in other applications of computer technology, the computer is not a substitute for professional judgment. It does relieve the architect of lengthy, repetitive calculations but it cannot make space in a hospital more easily interchangeable. Furthermore, not even a computer can help the architect satisfy more than 75 or 80 per cent of the acknowledged needs for space in specified relationships. For this reason if for no other, responsibility for managing the programming process now must be assumed by the client.

Devising a space program that strives to meet the diverse needs of a complex health care facility is a logical responsibility for the architect who ultimately will design it. Selling the wisdom of the program, so that design work can begin, calls for leadership within the institution. I believe that the hospital administrator is capable of providing leadership after he has shared management of the programming process with the architect and the consultant.



## DING DESIGN & CONSTRUCT



## Corporate headquarters preserves rustic scene

Mindful that this is an ecological age, Architects Vincent Kling and Partners gracefully set four stories of steel, glass and masonry in a pastoral scene at historic Valley Forge for National Liberty Corp.

If you're going to build a new headquarters complex in this ecological age, it makes good sense to select a 92-acre, picturesquely-wooded and rolling site with a stream winding through it. And also to have your building designed and located to preserve—and hopefully, enhance—that site.

That is what National Liberty Corp. did for its new headquarters facility near historic Valley Forge Park in southeastern Pennsylvania. The four-story steel, glass, and masonry building, placed unobtrusively at one of the site's lowest points, sits comfortably in its pastoral setting.

The building literally bridges the small stream, allowing it to flow unhampered. A man-made lake just north of the building adds a finishing touch to the rustic scene.

The architects, Vincent G. Kling & Partners, created an oblong building, 92- by 360-ft long. The longitudinal axis runs east and west. Masonry stair towers placed near each end of the north and south elevations accent the bridge effect by appearing to anchor the building to the ground.

#### Entrance court greets visitors

Employees and visitors, walking into the main building entrance at the far east end of the structure, first pass through a one-story vestibule area. They then move into a four-story-high reception court surrounded by window walls.

Because National Liberty Corp. is the parent company of a group of insurance and marketing companies, the headquarters building houses the several subsidiary firms. Each of the five subsidiaries functions separately but maintains a close relationship with the parent corporation. The

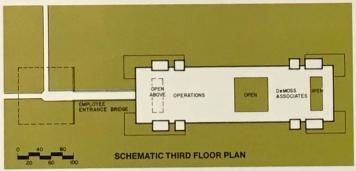








Placed on one of the lowest points of its 92-acre site, the National Liberty Corp. headquarters building sits comfortably in its pastoral setting, bridging a small stream which winds its way through the property. The design features a weathering steel and solar glass sun control detail. A four-story entrance court greets visitors.









A design feature is the four story reception court (above). Visitors enter the building at the east end, walk through a one-story vestibule, then into the reception court. Throughout the building, mechanical engineering needs are integrated with the color, texture, and patterns created by the interior designer. In the executive board room (far right), the ceiling detail is achieved by setting light fixtures into a pattern of concentric squares created by cherry wood batten strips. Another wood batten detail is featured in the employee dining room (left). Cherry wood is used throughout the building in casework and trim, as in the perimeter office (near right).



Vincent Kling

architectural design reflects this relationship.

Corporate executive offices on the top floor express the umbrella function of the parent company. On remaining floors, offices are located around the building perimeter with frequent interruptions to afford views of the surrounding countryside. A large employee dining room on the ground level is oriented to the open space over the stream.

Floor plans are based on a 20-ft bay. Eighteen bays run longitudinally; across the latitudinal dimension is a central 52-ft clear span area with one 20-ft bay at each end. The end bays accommodate 12-ft wide offices and an 8-ft corridor. The center clear span area provides unpartitioned general working space, except at the top floor where executive offices are arranged around an executive secretarial pool.

In the 20-ft bays, ceilings are 8-ft 8-in. high; in the 52-ft clear span areas, ceilings are raised to a 10-ft 6-in. height to achieve better proportions visually. The ceiling variation also lends itself to perimeter HVAC distribution.

# Materials relate to setting

The architects chose an earthy palette of materials and colors that would relate to the rustic setting. Helmut W. Krohnemann, the Kling project architect, explained, "We worked with natural materials such as masonry and weathering

steel. We think of weathering steel as a 'natural' material because of the oxidation process which it undergoes. That process will, of course, cause the material to take on a rich, dark brown patina that will complement the natural surroundings. To harmonize with the steel, the brick is a dark brown hue with a purplish sheen. Bronzed solar glass is featured floor to ceiling in windows."

The glass forms an insulating curtain wall consisting of a ½-in. air space separating an inside pane of clear plate glass and the exterior sheet of solar glass.

# Building has 'sunglasses'

The Kling designers added an additional sun control detail, which Krohnemann describes whimsically as "sunglasses" for the building. At each floor on the east, south, and west walls, a series of sheets of bronze-tinted glass are set into weathering steel frames and supported 3-ft from the window wall by cantilevered beams. A catwalk, also of weathering steel, spans the space between the framed glass strips and the window wall. The detail plays a triple role: sunshade device, window washing aid, and, most noticeably, an accent of contemporary design.

The building's interiors exhibit many examples of the close teamwork between the Kling designers and the mechanical engineers, Ferris & Hamig of St. Louis, Mo. For instance, in the

executive board room, a detailed ceiling was created by placing oiled black American cherry wood battens in concentric squares within a structural grid. The battens are set on a fiberglass acoustical panel covered with linen fabric. Light fixtures are integrated into the batten pattern. A perimeter soffit accommodates wall-washing light fixtures and air distribution grilles.

Cherry wood is used throughout the interiors in cabinets, trim, and other casework. It is also featured in linear batten strips in the employee dining room ceiling.

The headquarters building accommodates 750 people in its 137,000-sf. Now under construction and scheduled for completion in March 1973 is a second building, located just south of the headquarters structure. This building will provide 100,000-sf of floor space for insurance underwriting employees. They will be compatible and will be connected by corridor/bridges.

The master plan developed by the Kling office calls for preservation of an existing stone grist mill on the site which is belived to be about 200 years old. The master plan is an expression of National Liberty's underlying rationale for its developing headquarters complex—a rationale which honors the old while observing the new. As project architect Krohenemann puts it, "The buildings work with the land, not against it."



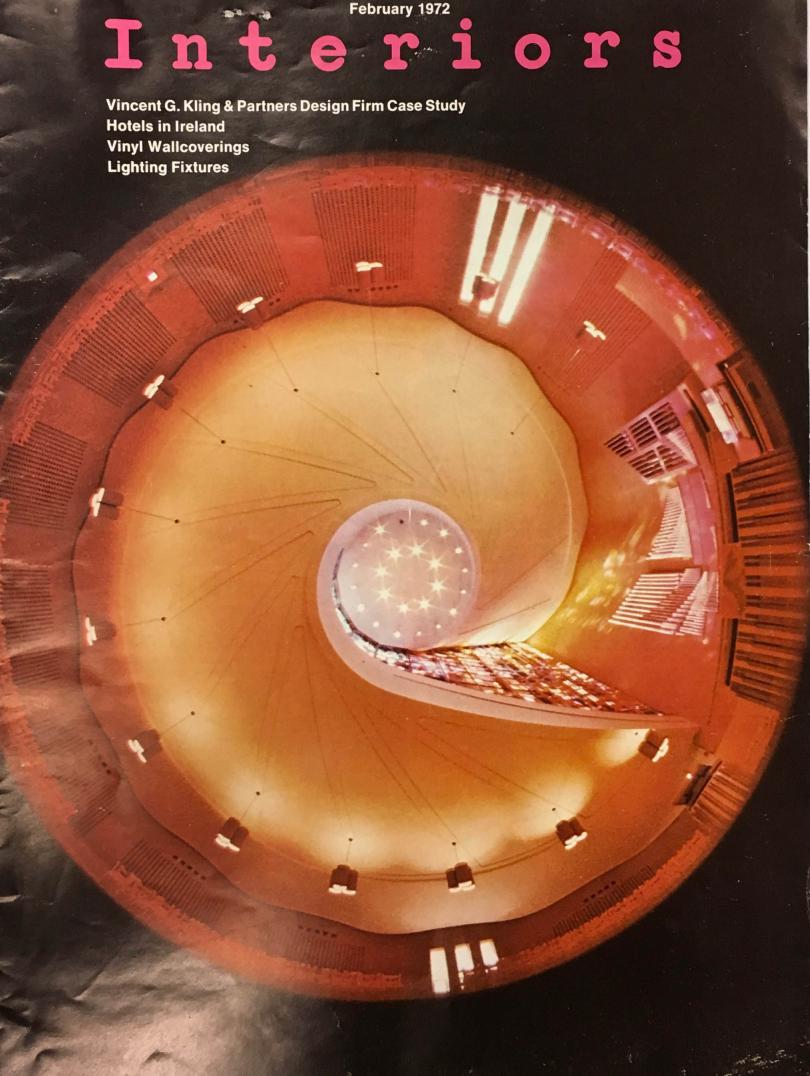


**Reprinted From** 

# BUILDING DESIGN & CONSTRUCTION

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February, 1972



# Vincent G. Kling & Partners

By John Anderson

Philadelphia's architectural giant moves toward closer harmony between architectural and interior design divisions as architect Don Kriebel joins Ralph Melick in directorship of Kling/Interior Design. Their major goal: Earlier involvement in the program and "people problems" that make a building work.

Vincent G. Kling's renowned architectural firm has been involved in interior design ever since Kling set up his Philadelphia practice in 1946 as a two-man operation. At that stage Kling was his own interior designer, as well as his own draftsman, model-maker, specwriter, and everything else. Growthminded from the start, Kling didn't stay small for long. His first major commission was the Institute for Cancer Research at Fox Chase in suburban Philadelphia, shortly followed by Lankenau Hospital in Overbrook, Pa., for which his firm earned the AIA's First Honor Award in Hospital Architecture in 1954. Today, Vincent Kling presides as Managing Partner over Philadelphia's largest architectural firm, and one of the largest in the country, with a staff of over 375 and more than 600 buildings to its credit at a total value of over two billion dollars.

sociateship (Vincent G. Kling & Associates) to a partnership on January 1, 1971, and at the same time further expanded its services as a multi-disciplinary environmental design organization. The firm now includes six divisions, under the following titles:

Vincent G. Kling & Partners—

Architecture

Kling/Leopold, Inc.—Engineering

Kling/Planning—

Landscape Architecture/Planning

Kling/Interior Design

Kling/Computer Sciences

Seri/Kling International—Paris

Elevating Kling/Interior Design

The Kling firm changed from an as-

In line with the partnership's intent to fortify its all-round competencies, the interior design division was recently strengthened with a new director, a new title (Kling/Interior Design), and a new directive to elevate the status of the interiors division within the firm. As a policy, Kling had always tried to get the interior design staff to work hand-inglove with the architects on each job. But the practice often fell short of the principle, and in too many cases the interiors group came in on a job rather late in the day. This was often due to

the fact that—as is true in many large architectural firms—the Kling interiors division had not always enjoyed the highest esteem of the staff architects. "Powder-puffing" was an appellation often heard in the architectural studios (especially from the younger architects) in reference to the services of the interior design division. It wasn't necessarily the quality of the work that got bad-mouthed; rather, the whole interior design effort left many of the architects cold and uninterested, as a lesser rung on the scale of creative endeavor.

on the scale of creative endeavor.

Kling himself never had such attitudes. He has always felt that the interiors of a building are an integral part of the architectural conception. "What happens inside a building determines what happens outside," he says, "and if you don't have this in mind while you're designing a building, you can get some pretty brittle results."

# Kriebel Named Director

Recognizing that a certain disharmony existed between the architectural and interiors division, the partners last fall bridged the gap by appointing Don Kriebel director of the interior design division, teaming up with Ralph B. Melick, who continues as administrative director of the division. Kriebel—a registered architect with a 1952 architectural degree from the University of Pennsylvania, and who later studied planning on a Fulbright at the University of Liverpool—has been with Kling for 16 years, serving for much of that period as a project architect.

In announcing Kriebel's new assignment, Kling last October sent around an All Staff Memo emphatically promoting "a more coherent working arrangement between the architects and the interior designers":

We must eliminate the break in sequence which tends to exist between building design and interior design. They are one and the same process, with certain people more endowed in one area than in the other.

"Understanding the people problems in our building designs starts with the earliest examination of the requirements which form the program, the concept of the spaces, their functions, their human touches, their creature comforts, their aesthetic merits, and their engineering concepts. We want the interior design staff to amalgamate with the architectural team in these early stages and stay with the process until the design is frozen. Don Kriebel has volunteered to undertake this task, and as head of the division, bring the necessary joint action and liaison into being."

It would seem that the right man was chosen for the job. Aside from the very important fact that Kriebel enjoys the respect and confidence of the architects as one of their own ("They know I know how to build a building," he says). Kriebel is intensely concerned with the intimate ways a building touches upon the individual-the individual who is not simply an observer but a user of the building. "Buildings themselves," he says, "-the way they look on the outside-doesn't really matter very much to the people who spend all day in them. No matter how beautiful a building, the people who live and work in it won't like it unless it works for them."

Snapshots in Kling interior design division:

Don Kriebel and Ralph Melick in conference room of interiors division. Wall panels in the square room are in two layers of eight different woods. Ceiling is equipped with varied lighting to test out colors under different light sources.

Jerry Sellers, Gabriele Windecke, Rebecca Gottshall.

Frederick Thomas

4.

Fran Rorer, Frances Robertson.

Karen Daroff.

Gabriele Windecke, Jerry Sellers.

Fran Marx Berit.

8.

Jeanette Kennard, administrative assistant. 9.

Samuel Joseph Merlino, Jr., Lucille Kaplan.

The reception area of the Kling offices is used for changing exhibitions by various divisions of the firm. This is a recent installation by Kling/Interior Design.





















The way a building works for people is perhaps as good a definition as one can get for the program of a building, and it is in this area that Kriebel and Melick place their highest hopes for the newly invigorated interior design division. "Sometimes I'm not quite sure whether the program made the building or the building made the program, Kriebel says with a laugh. And Ralph Melick adds: "The interior design staff should be involved very early in any building project, working with the architects from the beginning to develop a program that would really—and not just theoretically, or hopefully—work for the people that will use the building. Our interior designers should do a lot more interviewing, more research into the functional requirements, more testing-out of spatial solutions, before the architects go ahead with the building design."

"If we can overcome the egos of our architects," says Kriebel, "and they are ready to think of us not as cosmeticians but as allies and partners in achieving the best possible building, I think we can make it that much easier for them to get the building done."

### Melick the Administrative Head

Ralph B. Melick, who joined the Kling firm in January 1970 as head of the interior design division, continues in charge of administrative and fiscal responsibilities of Kling/Interior Design. An industrial designer by training (University of Cincinnati, 1962), he was a Senior Associate in charge of administration at Becker and Becker Associates in New York before joining Kling, Kriebel and Melick work together as a team, supplementing and reinforcing one another according to their talents and personalities. Kriebel is the spiritual center of the division, providing architectural and design control, and the vital link with the architects. Melick is the operational chief; he is the man in charge of budgets, manpower, scheduling, outside contacts, solicitation of new business, and the like for Kling/Interior

Kriebel and Melick both realize that

if their division is to gain a stronger standing in the architects' eyes, the interior design staff must improve and expand its own competencies, and adopt a prouder and more ambitious conception of its role. There are nine interior designers currently in the division in addition to Melick and Kriebel. They would like to add two more, with strong technical and architectural skills.

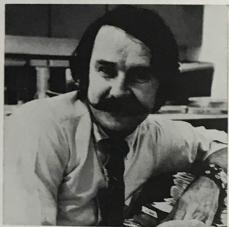
"We want our people to think more architecturally, and better understand the architectural concepts and problems," says Kriebel. As an architect himself, Kriebel values and comprehends the architect's intentions, and he directs and evaluates the interior designers' work for its suitability in a particular architectural conception.

### Increased Technical Skills

Kriebel and Melick also want to get more involved in mechanical systems—acoustics, lighting, air control, communications, etc.—and improve their liaison with Kling/Leopold, Inc., the engineering division of the firm. They want to test out the usability of spaces, with mock-ups, even more than they have done. And they hope to make greater use of the battery of computers available in the Kling offices. "A computer," says Kriebel, "can show you five different ways a space can work in a matter of minutes."

Kling/Interior Design is a separate accounting entity within the parent firm. Fees are based solely on time expended and do not include markup on specified furnishings. Full architectural discounts on furnishings are passed on to clients.

Even as Don Kriebel and Ralph Melick strive toward closer collaboration with the Kling architects, they also actively pursue independent work for Kling/Interior Design, in buildings (new or old) by other architects and in older Kling buildings that come due for interior remodeling. One assumption they wish to disabuse prospective clients of is that the enormous Kling firm is interested only in enormous jobs. Kling/Interior Design wants the smaller jobs, too, and they feel that the back-up provided by the parent firm puts them in a sound



Don Kriebal



Ralph B. Melick

position to deliver a highly polished product with the utmost efficiency in jobs of any scale. The interiors division uses such services of the parent firm as drafting, estimating, and computerized specification writing and scheduling. "We have the space for building mockups," Kriebel and Melick point out; "we have computers available for space studies; we have technical experts in lighting and acoustics and communications and air conditioning right here. All told, our interior design division has a tremendous advantage in being part of a big environmental design firm like Kling."

# An Interview with Vincent G. Kling



(INTERIORS' Contributing Editor John Anderson had the following conversation with Vincent G. Kling, founder and Managing Partner of Vincent G. Kling & Partners, one day last fall.)

Q: Mr. Kling, when did you first set up an interior design department?

Kling: We've always had an interior design division. To my mind, there is no such thing as interior architecture and exterior architecture—they're one and the same thing. What happens inside determines what happens outside, and if you don't have this in mind while you're designing a building, you can get some pretty brittle results.

Q: How do your interior designers work with the architectural staff?

Kling: It's a collaborative thing. I try to get the architect and the interior designer to work together on a job right from the early stages of determining the program, and collaborate throughout the design process. Some people are more endowed with decorative talent, and more interested in the intimate aspects of a building and how people live and work and feel in them. We need these people just as much as we need architects and planners who think and conceive on the larger scale.

The engineer is a third party in the architectural process, and we aim for a federated attempt at the solution, with the architects, interior designers, and engineers making decisions in consort. For example, take cold cathode lighting—this is at once an architectural problem, an engineering problem, and an interior design problem. If you're going to use cold cathode lighting, what under the sun can you do to humanize the space? This is the kind of problem we want our interior designers to help solve.

As another example, many interior design firms don't understand the need for smoke extraction equipment in conference rooms and other closed spaces where everybody's smoking up a storm. Here again you need collaboration between the designers and the engineers.

We do not think of interior design as powder-puffing—we think of it as a way to help a building work for people. Our interior designers have to understand as much as the architect does about sound and light—about draughts and glare—about communications systems—about all the different ways a building functions as a human environment. For every job we do, we mock-up repeat spaces long before architecture begins, for functional prove-out as well as atmosphere. This again is a collaboration between the architect, interior designer, engineer—and the client.

Q: Does the interiors division take on interior design jobs independently—in older buildings, or in new buildings by other architects?

Kling: Yes. We're putting more effort into our interior design department as a separate entity. Renovation of existing spaces should be a big new thing for us. We have six or seven hundred buildings behind us now-we've created a kingdom of our own, in terms of followup possibilities. When we go back to see how they're working, we find that only a very tiny percentage of them keep their space as we left it. We always try to leave the client with the best understanding of what we did-but then things happen. People attempt the remodeling on their own, and the results are almost always bad. We could do a lot of teaching in this area, and come up with any number of redesign assignments in our old buildings.

Q: Why did you change from an associateship to a partnership in January 1971?

Kling: Partnership gives us an open door to create a growth potential. We've been functioning as a partnership for years. The reorganization is a step up from associateship, to give our top people—the people who are helping us grow—appropriate recognition, and a good income structure. People in an ownership position have pretty strong motivation. Being a partner also gives these people more authority outside the firm.

# First Pennsylvania Banking and Trust Co., Philadelphia

In a thoroughly controlled aesthetic conception, architect and interior designers collaborate to create sculptured spaces of rare beauty

Associate in charge: Harry Peschel Project architect/designer: William Heim Interior designers: Fred Thomas, Diana Curtis



View toward elevator lobby from curved wall of bronze-tinted glass that forms backdrop for major reception area. Cast bronze sculpture by Dennis Leon.

The design imagination that conceived the executive floor for First Pennsylvania Banking and Trust Co. functioned, to a very rare degree, like that of a painter, sculptor, or composer-artists whose essential vision is to communicate a sensuous experience in form. Architect William Heim created a sequence of enveloping spaces that, while well serving the operational requirements of the floor, embody a vivid and special quality of feeling, at once arresting and calm, rarefied and quietly impassioned.

The offices are not in a Kling building but in the Packard Building, one of downtown Philadelphia's important older structures in which First Pennsylvania, largest banking institution in the city and oldest in the nation, has long resided. New offices for top management were required to accommodate a recent change in the bank's corporate structure which came about with the creation of a new holding company titled the First Pennsylvania Corporation. The holding company offices are to the left of the elevator lobby, bank offices to the right.

The heart of the environmental concept is the circulation area, comprised of a gallery, reception areas that open up at either end, and the elevator lobby. The gallery is a plastic and sensuous perambulatory space of varied width and serpentine route, bearing little resemblance to a conventional straight corridor. On either side, curved solid walls of sprayed white plaster alternate in irregular rhythm with transparent walls of bronze-tinted glass. Behind the glass panels are secretaries' offices offering deeper views to bright-colored draperies at the windows. Behind the opaque curved plaster walls are executive offices and the board room. The sculptural "in-out" movement of the gallery space is enhanced by variable lighting of great expressiveness. Illumination in the gallery itself is subdued, with the walls in darkness and pools of light falling on sculptures, paintings, and plants. Reception areas at either end are more brightly lighted, with washes of light on plaster walls and on the travertine wall in the elevator lobby. Cold cathode lighting above two large round columns add to the overall sculptural lighting. (No

photographers' lights were used in the photos shown here.) Art works from the bank's fine collection of contemporary art "float" in the neutral, almost monochromatic surround of white plaster and light beige carpet.

Interior designers Fred Thomas and Diana Curtis joined architect Heim to develop the environmental concept in detail, ensure its practical usability, and sustain the tone and style throughout, The velvety textured carpet, with its shimmering response to light, extends throughout the floor, which is entirely lit by incandescent downlights. The executive offices continue the all-white surround with dense white casement curtains similar in color and texture to the plaster walls and ceilings. The rounded sculptural motif also recurs in the executive offices in a variety of ways. Several of them have concave conference areas (these are the inner sides of the curved walls in the gallery), most have ceilings that gently curve into wall surfaces, and some have arched plaster frames for windows or for space divisions within a suite.

All desks and tables on the floorboth standard and custom pieces-are of rosewood in selected and matched veneers. Upholstery colors are warm and earthy nubby textures and leathers, with occasional reds and oranges lending color spark.

Upper right:

View of inner reception area from secretary's desk behind glass panels. Curved plaster wall is brilliantly lighted, emphasizing silhouettes of antique clock, black leather chairs, tall sculpture of black painted wood by Louise Nevelson.

Right:

View of gallery. Polished bronze sculpture on rosewood pedestal by Ernest Trova; acrylic painting by Edna Andrade.

photographs by lawrence s. williams, inc.

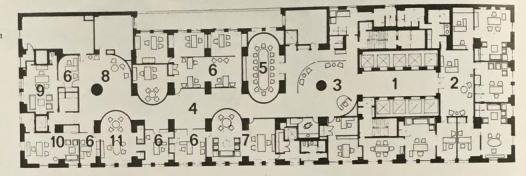




# First Pennsylvania

- 1 Elevator lobby
- 2 Reception
- for First Pennsylvania Corporation
- 3 Reception
- for First Pennsylvania Bank
- 4 Gallery 5 Board room

- 5 Board room
  6 Secretaries
  7 President's suite
  8 Inner reception area
  9 Chairman's office
  10 Vice chairman's office
  11 Senior vice president





President's office is a large L-shaped space with three zones: one for his desk, another for a "living room" area, and a third for an informal conference area, residing in a curved niche (right background).
Rosewood batten ceilings recur here, also having been used in the elevator lobby. Desk chairs and conference chairs are in dull gold mohair plush; lounge seating in dark brown fabric. Polished bronze sculpture by Miguel Berrocal; acrylic collages by Robert Peak.

Desk: Lehigh. Desk chairs and conference chairs: Zographos in Schumacher fabric. Conference table; lounge seating: Zographos.



### Above:

Senior vice president preferred a simple oval table as a desk. Plaster ceiling is molded, in accord with the curved motif of the overall space, and this office includes one of the curved conference niches (to right of photo). Watercolor by Milton Avery.

Table and chairs: Zographos. Upholstery: American Leather; Knoll Textiles.

## Right:

Chairman's office has display niche built into "living room" area wall that gently curves into ceiling. Dense white casement fabric is used in all executive offices, similar in texture and color to white plaster walls and ceiling.

Desk: Eppinger. Desk chairs: Knoll, in American Leather and red Larsen fabric. Sofa and lounge chairs: Zographos, in American Leather.

### Right.

Vice chairman's office in a corner location exhibits another variation on the molded plaster surround, with arched treatment of far window.

Desk and credenza: Eppinger. Desk chairs: Knoll in golden brown Larsen fabric. Lounge seating: Zographos in ginger Knoll fabric. Rosewood coffee table on bronze base: Zographos.





# First Pennsylvania

Right:

Board room is an elegant oval space with rosewood batten walls and cove ceiling with cold cathode lighting. Custom table and wall-hung cabinet are also rosewood. Chairs are in scarlet plush. Paintings of acrylic lacquer on paper by James Havard.

Table; cabinet: Executed by Interior Milling. Chairs: Brickel, in Larsen plush.





View from gallery into secretarial office and two private offices behind a second wall of bronze-tinted glass panels. Rosewood desks are from selected and matched veneers. Orange upholstery and draperies lend bright color to these deep views off the neutral-colored gallery.

General sources:
Carpet: V'Soske. Custom furniture and millwork: Interior Milling. Drapery fabric in executive offices: Knoll. Drapery fabric in secretarial offices: Jack Lenor Larsen. Drapery hardware: Kirsch "Ripplefold." Secretarial desks: Lehigh. Reception area chairs: Lehigh, in American Leather. Planting: Grant-Leighton. Accessories: Burke-Acton; Smith Metal Arts. Contractor for furniture, carpet, draperies: John Wanamaker's.

# Union Carbide Technical Center, Tarrytown N. Y.

Unadorned interiors stress the architectural vigor and country setting of a spine building spanning a road

Partner in charge: John Larkin Staff architects: John Lynagh, David Duelp Landscaping: Vincent G. Kling & Partners

Union Carbide Corporation's new technical center in Tarrytown, N. Y., large as it is already, is only the beginning of a much bigger complex of research facilities planned for the chemicals and plastics firm. To make the most efficient -and exciting-use of its 300-acre country site bisected by a highway, Vincent G. Kling & Partners designed a "spine building"-a horizontal spine spanning Old Saw Mill River Road that can be lengthened to both north and south, and on which additional buildings can be added to east and west. The spine carries a central distribution system for pedestrians and materials. Raised above the center section of the spine, over the road, is a two-story office building supported by massive concrete piers on either side of the road.

Various public interiors were designed as strong, dramatic, unembellished architectural spaces. The main lobby powerfully expresses the spine concept of the building with its imposing overhead walkway connecting the two sections of the technical center on either side of the road. The dining room just off the main lobby is oriented outward, with a trio of rounded outcroppings amplifying the outdoor views.

The western extension off the south end of the spine houses the Linde laboratories. A pair of skylighted three-story galleries in the center of this extension are pleasant park-like spaces where Union Carbide people can gather informally, leaving their labs and individual tasks to gain a sense of contact and belonging with the company as a whole. Exposed structural concrete, solar gray glass, brick paving, and partitions often of concrete block continue the architectural expressions in these interior spaces.

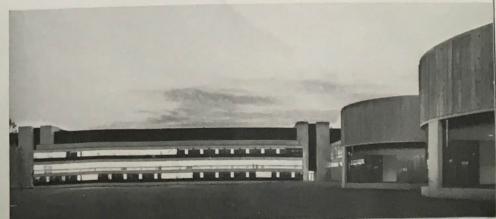
Top photo:
Two-story office building is raised over
central portion of the spine. Dining room
lies behind three curved outcroppings.
Center:

Old Saw Mill River Road cuts through building. Glass-walled 20-foot-wide walkway is suspended above road.

Linde laboratories occupy west wing of building, in background.











**Union Carbide Technical Center** 

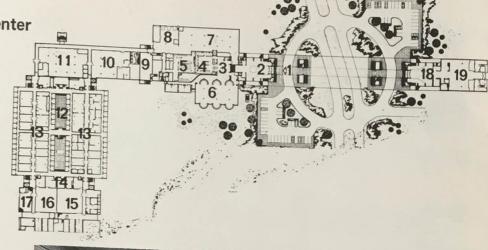
- 1 Main entry
- Main lobby
- 3 Dining lobby
- Serving line
- 5 Kitchen
- 6 Dining room
- 7 Materials handling center 8 Loading dock

- 9 Storage 10 Model shop
- 11 Machine shop
- 12 Galleries 13 Laboratories
- 14 Compressor room
- 15 Scarfing high bay
- 16 ABC furnace high bay
- 17 Manned diving
- 18 Library control and reading room
- 19 Stacks

# Right:

Main lobby with its imposing overhead walkway which continues across the road. Round oak receptionist's desk and massive furniture pieces in neutral colors fall naturally into place in this massive and unadorned space which reads simply as the inner side of the concrete and glass architecture, brightened with a red carpet.

Receptionist's desk: Custom Kling design ex-ecuted by Eckert & Johnson. Lounge chairs: Harvey Probber. Carpet: Alexander Smith, of Union Carbide's Dynel.





### Right:

Three curved glass-walled extensions of the dining room project lunchers into the landscape. The dining room is sunk a little below grade, raising the outdoor green to almost eye level.

# Facing page:

The two central galleries of the Linde laboratories are three-story skylighted spaces resembling outdoor plazas with their brick paving and tall trees. Sumptuous lounge seating makes the galleries attractive gathering places for laboratory people from both sides of the galleries. Offices overlook the galleries; some have solar gray glass walls, others just glass balustrades. The labs themselves are windowless interior spaces, with another row of private offices on the perimeter. To provide the required headroom in the labs, two floors of laboratory space equal three floors of office space; offices of lab personnel are on the same floor as the labs, and administrative offices occupy the

Lounge chairs: Harvey Probber; Jens Risom. Fiber glass planters: Architectural Pottery. Balcony seating: Knoll.



# Vincent G. Kling & Partners

# National Liberty Corporation, Frazer, Pa.

Sophisticated architecture and inviting interiors in a country setting reflect the client's commitment to both future and past

Partner in charge: Jonathan P. Naylor Staff architect in charge: Helmut W. Krohnemann Interior designer: Sam Merlino





Lobby sources: Reception desk, cherry with black marble top: Kling design executed by Interior Milling. Lounge chairs in black leather: Stow/Davis. Oriental rugs: Fritz and Larue.

President's office: All furniture: Kittinger. Carpet: V'Soske. Drapery fabric: Lee Behren. Sheer curtains: Maharam.

Board room: Table: Kling design executed by Interior Milling. Chairs: Stow/Davis. Carpet: V'Soske. Silk fabric wall panels: Lee Behren.

National Liberty Corporation is a twelveyear-old life insurance company whose striking success in the business world has been won without the slightest compromise of the owners' dedication to American history and Christian tradition and principles. The company thinks of itself as a family, united in religious faith and moral scruples as well as purposeful enterprise. To provide a new home for the expanding firm, owners Mr. and Mrs. Arthur De Moss asked Vincent G. Kling & Partners to assist in the selection of a site in the general area of Valley Forge. The site chosen had the greatest aesthetic potential, as well as historical significance, with a small stream running through the property in a rolling countryside. The site also allows for further expansion, and ground is already broken for a second building.

The building is a completely contemporary structure that, with its low profile and brown coloring of weathering structural steel, brick, and bronzetinted glass sunscreens, blends warmly into the landscape. The building spans the stream, and a small lake was created on the higher ground. Offices focus outward on the lovely setting.

The interiors were designed to further enhance the enjoyable and creative environment, reflecting the firm's commitment to the future as well as its ties to the past. Religious inscriptions and symbols occur in various spaces, and an electric carillon plays Westminster chimes at predetermined hours.

The lobby (left) is a three-story atrium capped with a skylight, paved in brick, with clear glass walls framed in painted steel. A pair of Oriental rugs in yellow and black humanize this exciting space and introduce a traditional note. The president desired a traditional office with the gracious air of a living room (upper right). Cherry paneling and a deep blue carpet form the appropriate background. The board room (lower right) is square with a round cherry table and wall panels covered in silk. In this square space, the circle of chairs in bright red work beautifully against the deep blue carpet.





# Vincent G. Kling & Partners

# Central Penn National Bank, Philadelphia

Arcaded bank on second floor continues the major architectural theme of Kling's final structure in the Penn Center development

Partner in charge: Dan Peter Kopple Architectural designer: Peter Aarfa Project architect: John Todd Interior designer: Lucille R. Kaplan





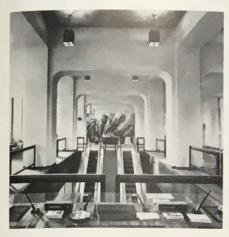
Vincent G. Kling & Partners have been the masterminds of Penn Center since the huge urban renewal project in downtown Philadelphia began in the late 1950's. The Kling firm spearheaded the development of the master plan for the complex of office structures, plazas, pedestrian walkways, and public transportation facilities. Kling also designed several of the major buildings, including the 36-story Central Penn National Bank Building completed in 1970, which is the final structure in Penn Center.

The most unique feature of the building is a broad open-air arcade under three sides of the building which, out of consideration for the building's place in the city's heartland, opens most of the site to pedestrian use. There are no shops or rental spaces on the street level. Even the main banking area is on the second floor, as a platform suspended above the sidewalk from a thirdfloor cantilever.

The bank interiors elaborate on the building's arcaded theme by creating an all-around plaster interiorscape of massive columns and broad arches. Since the bank has been so modest as to retire to the second floor, it was given dramatic access with a large escalator well cut through the floor. The interior organization of bank facilities responds smoothly to this huge gash in the center of the floor, with the officers' platform extended as a single file of desks along the windows, and the tellers' counters arranged as a square enclosure of teak neatly tucked between four huge columns. The high ceilings-which seem even loftier because of the plaster arcades-are of the same glazed tile as the outer lobby ceilings on the ground floor. A red carpet makes a sumptuous platform from which to view the city scene below.

The officers' platform is pictured at right.

Tellers counters, check desks, special tables: Executed by Interior Milling. Desk chairs: Brickel Associates. Lounge chairs: Stendig. Carpet: James Lees. Accessories: Smith Metal Arts. Ceiling tiles: Globe; Integrity Tile Co.







Top left photo: Top left photo:
Free-standing mural by artist Glen Michaels
stands at the head of the escalators,
screening private offices. The mural is
of tiles, pieces of brass square rod, and
cast bronze elements, resembling brush
strokes in an abstract painting.

# Above:

Above:
Teak tellers counters were designed by
Kling architect Peter Arfaa to fit into the
square created by four massive columns.
Check writing stands and bench seating
are of the same wood. Lucille Kaplan
designed the round tables, also of teak.

# Vincent G. Kling & Partners

# PMC Colleges Library, Chester, Pa.

Brick and concrete triangle built around central "keys" area becomes the focal point of an expanding campus

Partners in charge: John Rutkowski, Eric Chung Staff architect: Helmut Krohnemann Interior designer: Diana Curtis





The design of the Wolfgram Memorial Library at PMC Colleges grew out of an exceptionally clear perception of the building's roles in the life of the college. The library, though relatively small, was to be the most important structure and focal point on an expanding campus. Symbolically, it was to express the institution's new emphasis on academic achievement, since PMC was recently reorganized from a military school into a larger civilian-oriented college of arts and sciences. And functionally, the library was to invite maximum use by the students through personal service and an informal workshop atmosphere. Furthermore, the building had to permit future expansion.

All of these requirements pointed toward a triangular building. The site faced two dissimilar spaces: to the west was the heavily traveled central plaza of the campus-a dynamic space-while the east faced the rather static and formal green space of the Parade Field. The west exposure was thus made the most dramatic apex of the triangle, with broad and flaring stairs leading up from the plaza to the main entrance. The straight east wall faces the Parade Field. When the master plan is completed, two of the library sides will angle toward projected academic complexes, and the library will still be the focal point of the campus. The building, of exposed concrete and brick to relate to older campus structures, can be expanded by as much as 60 per cent by building outward from each leg of the triangle.

At least as important as site considerations in influencing the form of the building was the way the library was to work. A major requirement was a central "keys" area, so called because it holds the keys to the library's contents — book catalogs, bibliographies, periodical indices, and general reference works. This keys area is dramatized as a two-and-a-half-story central triangular court, capped with a powerful ceiling of concrete triangles. Reference librarians, reading areas, and outer fringes of book stacks surround the triangular central area on all three sides.

continued on next page



# **PMC** College Library





The spirit of the building is that of an informal and stimulating workshop in which the various services are easy to find and use. Reading carrels line the balconies, adjoining the outer stacks. Reading lounges at the rear apexes of the triangle are quiet and relaxed retreats. The ground floor, below the keys area, holds an array of audio-visual facilities, a multi-media lecture room, and facilities for closed circuit television, as well as book stacks and reading areas.

The fourth floor, out of general circulation, stores up to 60,000 seldomused books and periodicals. Mechanical and air-conditioning equipment is housed in a penthouse directly over the central court. This "hat" is illuminated at night to act as a beacon for evening strollers.

Reading tables line the balconies overlooking the central court, convenient to book stacks on the outer edge. Chandeliers designed by Kling & Partners of cherry, acrylic, and brass lend glitter and drama to the overall space of the center court while providing illumination at tables.

One of the triangular-shaped reading lounges installed in the rear apexes of second and third floors. Graphics, from left to right, by Edna Andrade, Takawashima, Martha Zelt, Edna Andrade.

Library chairs: Knoll. Library tables: Sjostrum. Custom cherry partitions and cabinets: Interior Milling. Bookstacks: Holloway/Estey. Chandeliers: Executed by Habitat. Lounge chairs: John Savoy, in Maharam fabrics. Armchairs: Gunlocke, in Maharam fabric. Low round tables: John Savoy. Carpet: Oxford Mills, through Livesy, Inc. Graphics: Marian Locks Gallery. Planting: The Plant Place.

# Randolph-Macon Woman's College Chapel, Lynchburg, Va.

Undulating walls and harp-shaped stained glass window embellish interior of a brick chapel in the form of a nautilus

Partner in charge: John Rutkowski Designer: Joseph V. Marzella Project architect: A. E. Beck

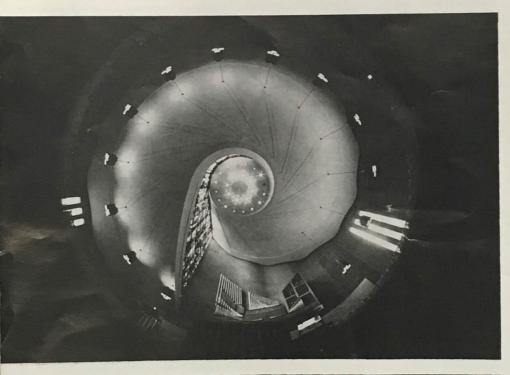
The chapel at Randolph-Macon Woman's College, like the library at PMC Colleges, was planned as a focal point in the master plan for future campus development. The program called for an interdenominational chapel to accommodate a congregation of 350 and a choir of 60. Besides worship, the building was to be used for cultural programs such as organ concerts, music recitals, interpretive dance, and lectures. Architects Vincent G. Kling & Partners determined that a round building would best serve the diverse requirements, and the result is a simple nautilus-shaped chapel with a structural brick wall that spirals upward to a height of 95 feet above the entry

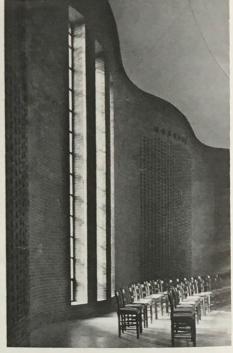
Interior walls, of the same red Virginia brick as the exterior, undulate gently, for both aesthetic and acoustical purposes. The walls are pierced at intervals with brick grillwork, behind which is sound-absorbing material. A large harpshaped stained glass window designed by Marco Zubar floods the interior with color. Tall narrow windows also let in daylight. The roof is a series of steel trusses, each one meeting the succeeding truss tangentially as the roof climbs to its peak. A deeply paneled plaster ceiling is suspended between the trusses.

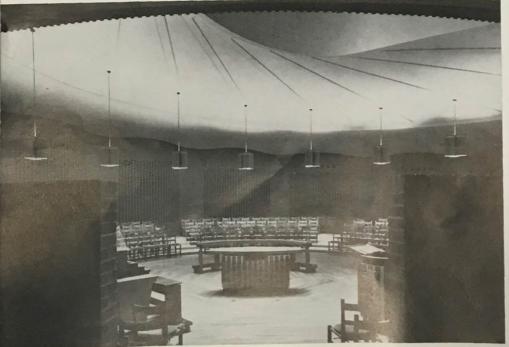
Chairs are arranged in circles rising in gentle steps around the worship center. The choir section beneath the organ pipes is part of the circular pattern. The first rows of chairs may be removed to allow room for non-liturgical performances.

photographs by lawrence s. williams, inc.









Upper left: View to the top of the nautilus (pictured in color on our cover).

Above: Tall narrow windows bring shafts of light inside.

Right: Chairs encircle the central altar on rising steps.



# aterio

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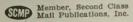
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## FEBRUARY 1972

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### AMERICA'S GREAT SOURCES

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Kling's nautilus-shaped chapel at Randolph-Macon. Photograph by Lawrence S. Williams, Inc. (see pages 77-79).

### NEXT MONTH

WEYERHAEUSER headquarters in Tacoma, one of the first major buildings in this country designed specifically and from the start for office landscape interiors, a spectacular landscape in a land-scape by a team consisting of Skidmore, Owings & Merrill, San Francisco, for architecture, engineering, interior design; Sydney Rodgers Associates, Inc., for space planning; Knoll International for systems design; Sasaki, Walker Associates, Inc., for landscape architecture . . . RETAIL PREMISES section will show BUL-Welton Becket & Associates . . . Roos/Atkins Beverly Hills by Burke, Kober, Nicolais, Archuleta . . . Gubelin store for jewels on Fifth Avenue by Gerhard Karplus . . . Preview of the AID's SOUTHWEST REGIONAL CONFERENCE in Santa Fe, in April, along with a New Mexico house by architect Antoine Predock . . . RESIDENTAL FURNITURE from the winter markets in Chicago, Paris, Cologne . . . KNOLL AU LOUVRE retrospective exhibition . . . HER-MAN MILLER CONTACT FURNITURE AND HOSPITAL SYSTEMS NEWS.

The Mosler Safe Company 1561 Grand Boulevard Hamilton, Ohio 45012 Telephone: 513-867-4000 July 20, 1973

Mr. D. Q. Permenter Security Officer United States Mint 320 West Colfax Avenue Denver, Colorado 80204

Dear Mr. Permenter:

Mosler

Just a note to thank you for the courtesies extended during my recent visit to the Denver Mint with Mr. Carl Sundquist, of our Denver office. At the time of our discussion we mentioned that we would send you information which we felt might be of assistance to you as it relates to various forms of instruction for vault security and electronic protective systems for building security.

Attached hereto is a copy of the Federal Reserve guidelines relating to vault construction and electronic security devices. We hope that this information will be beneficial to you and you might like to review it with Colonel Rhea as I am sure that at this early stage your preliminary planning will be very important.

We would like to bring to your attention that our organization stands ready to be of assistance to both you and your architect during the planning stages of this project. Please feel free to contact Mr. Sundquist at our Denver office should you need additional information.

Sincerely,

MOSLER

James D. Eagleson Coordinator of Major Projects

JDE/bw

cc: Carl Sundquist Walter Sands

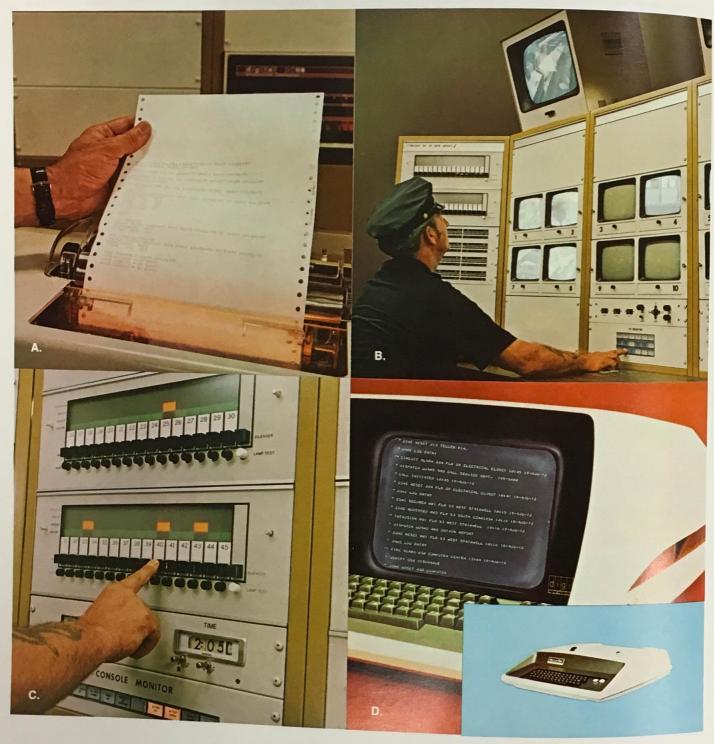
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# Security Command Centers



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# Technologically advanced security systems custom-designed to integrate with your risk management program

Mosler 300 represents a new generation of security system design. Conceptually, it is a blend of the latest computer, electronic and electromechanical technologies proved to be most effective in over 75 systems protecting business, financial, government and industrial complexes. More than just hardware, Mosler 300 is the embodiment of skill and experience leading to a degree of reliability and cost-effectiveness that only Mosler can offer.

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Integrated control of multiple risks Mosler 300 is actually many systems in one ... integrated in such a way to provide maximum protection for your investment. Dependent on your requirements it will:

Detect incipient fires and unauthorized intrusion.

Monitor hold-up alarms and access to protected areas.

Maintain CCTV surveillance of sensitive locations.

Serve as a center for intercom, telephone and radio communications.

Incorporate Mosler card access control system on a fully-integrated basis.

Produce a computer-printed record of all security activity, counter-measures and system status.

Supervise guard tours and monitor vital functions such as heating and air-conditioning.

Instruct console operators on procedures to follow in emergencies through computer-controlled printed and/or visual media.

# The advantages of computerized systems

Modern computer technology has substantially increased the effectiveness and operational facility of security systems. Mosler 300 takes maximum advantage of available computer memory capacity to give you the controls you need. Its computer is programmed to print records in easily-understood, non-abbreviated language of all security activity, provide instructions for console operators in either a print-out or visual display, generate a printed summary of security status, present this information at a remote supervisory location and automatically change access/secure condition of individual zones.

### Plan ahead with Mosler

UL 611 and NFPA 72D (Class A) codes are being revised. Under consideration is a requirement that all computerized security systems have a second, back-up computer to assure continuous system operation. Mosler 300 will comply with this probable code requirement, not by adding a back-up computer, but through a unique system design that utilizes the computer in parallel with a visual display.

Systems engineered for humans As security systems grow more complex, it is increasingly important to take the human factor into consideration. A system may react in milliseconds; but the human brain still takes many seconds to comprehend, evaluate and direct countermeasures. Mosler 300 was designed for people. For example, CCTV displays and controls are arranged so that the console operator can effectively monitor all locations during normal periods, and yet, will allow smooth functioning with an additional operator during peak periods if necessary. All alarms are displayed individually on flush, back-lighted panels which are not extinguished until the alarm is reset. Thus, in case of multiple alarms, the emergency pattern is immediately apparent. Computer descriptive and instructional printouts are fully written out, eliminating mistakes that terse abbreviations may cause.

# A typical Mosler System designed to secure a large urban building

# A. CCTV Tape Recorder

Recorder provides a visual record of emergency situations in locations covered by surveillance cameras. System can be designed to start recorder automatically in response to pre-selected alarms.

B. Hold-up and Distress Panel Audible and visual signals indicate hold-up or other emergency assistance conditions. Alarm initiating devices are usually located in sensitive areas throughout the building.

C. Security Communications Panel All controls for required telephone. radio, intercom and call signal systems are conveniently mounted on console.

D. CCTV Surveillance Monitors Small screens continuously monitor all camera locations, Console operator can switch any display from small to large screens for supervisor viewing. Pan-tilt-zoom cameras are available which allow operator to "zero-in" on portion of monitored area. In response to hold-up or other selected alarms, the system will automatically switch pertinent TV scene from small to large monitor screen. Flashing light and audible alarm alert operator to the emer-

E. Security Control Panel

gency.

Panel displays and controls access/secure condition of secured areas, Lights and audible alarm indicate unauthorized opening or operation of protected entranceways such as doors, gates and elevators when system is in secure mode. Circuit failures are indicated by separate set of panel lamps. Alarm lights remain lit until circuits are reset.

### F. Fire-Alarm Panel

Audible alarm indicates emergency. Panel lights pinpoint location of activated sensors which may be thermostats, products-of-combustion detectors, manual alarm signal boxes, sprinkler system waterflow indicators, CO2 and Halon discharge and other monitoring devices.

G. Card Access System Panel Mosler card access system is fully integrated into console's security circuitry. Unit encodes cards, generates individual code numbers and prints record of all card access sys-

propriate signals on the console security panel.

H. Emergency Instruction Display When an alarm is activated, pertinent instructions for console operator are projected on this screen, Display shows floor diagram with location of detection device and step-by-step instructions for operator to follow in handling any particular emergency.



# I. Computer and Printer

Automatic, computer-controlled highspeed printer records, in easilyunderstood, non-abbreviated English, all system alarms and actions taken by guards. It will also print specific instructions for console operators in emergencies, summarize current system status and a summary of occurrences over a designated time period. Locked keyboard provides a means to input computer programs by authorized personnel. A CRT type display is an alternative means for presenting computer-generated information. (See inside front cover.)

# J. Audit Record Printer

(Not Shown) Digital printer records, in abbreviated form, time, date and location of all alarms and resetting of those alarm circuits to provide a permanent audit record of system operation. It will operate on standby battery power and function as a back-up system for the computer-printer unit in case of commercial power failure.

# K. Guard Tour Panel

(Not Shown) Panel lights indicate guard tour progress from station to station as they key-operate switch boxes. Any route deviation or excessive time between stations activates visual and audible alarms.



# Additional reasons why so many security-conscious companies have specified Mosler

# "Hi-Line" security

For highly-sensitive or high-value areas such as computer rooms and vaults, Mosler offers you a line security system currently in operation in over 1000 locations that has yet to be compromised. It utilizes a highly-complex digital coded signal on an interrogation-response basis that cannot be compromised by means of externally-applied AC, DC, random noise or other tape-recorded signals.

Simple, reliable standby power All Mosler 300 sensors, lines, alarm indicators, audit record printers and intercom systems operate on lowvoltage DC. This means that only a small bank of batteries is required to maintain full security in case of commercial power failure. In contrast, other systems, which rely on continuous computer/printer operation, must have a very large battery and inverter system to deliver 110 V. AC power for a specified time period. And, if multiplex line techniques are employed, 110 V. standby power must be brought into each transponder location.

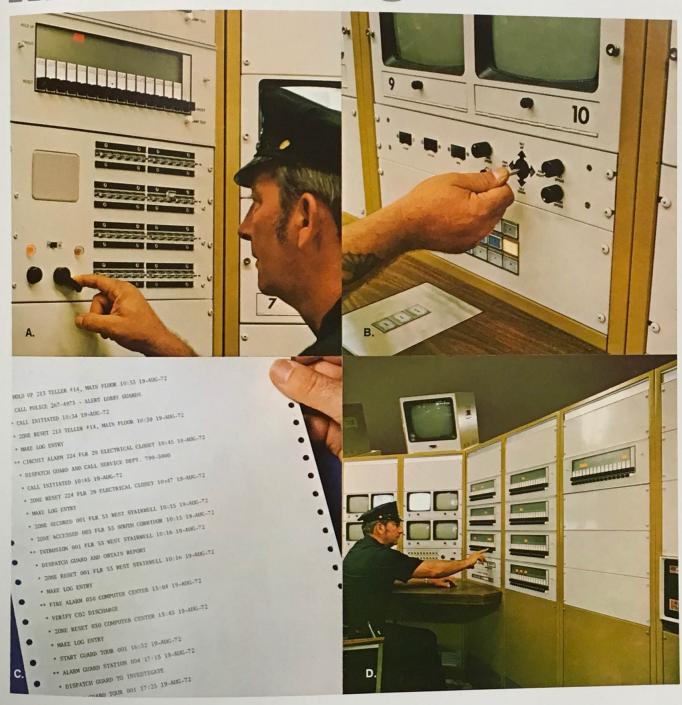
### Constant alarm line security

The time you switch your system to the secured mode is no time to discover that your alarm lines have been tampered with. Therefore, we designed Mosler 300 to detect immediately any circuit failure in both the access or secured modes. Other systems that employ common transmission lines do not offer you this important security feature. In addition these systems will not function in the event of deliberate or accidental damage or electrical interference to common transmission lines. Mosler 300 parallel system design works full time to give you the protection you have a right to expect all the time.

### One responsible source

The "buck" stops at Mosler-whether it concerns the design and manufacture of equipment made by us or to our rigid specifications by carefully selected suppliers. Or the installation of systems by experienced professionals. Or system maintenance by our nationwide staff of trained and bonded servicemen who are fulltime security equipment specialists. They are backed by our 60 years of experience in the security alarm field and in working with consultants, architects, contractors and tradesmen. When you specify Mosler, you can be sure that your system will be installed at minimum cost and that it will give you the protection you paid for.

# Mosler 300



Mosler

An American-Standard Company

Hamilton, Ohio 45012

GUIDELINE

MANUAL

FOR

SECURITY PLANNING

IN

NEW CONSTRUCTION

BOARD OF GOVERNORS
OF THE FEDERAL RESERVE SYSTEM

DIVISION OF FEDERAL RESERVE BANK OPERATIONS

(Revised July 1, 1970)

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PROTECTION FACILITY CONSIDERATIONS
WHEN PLANNING NEW CONSTRUCTION OR
MAJOR RENOVATION OF FEDERAL RESERVE
BANKS AND BRANCHES

(Revised July 1, 1970)

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### 10. GENERAL

These protection recommendations and suggestions are intended to be used as guidelines for bank officers, architects, and engineers involved in planning a bank construction or major renovation program. Much of the information is set forth in generalities which identify desirable protection features to be implemented in the most advantageous manner and to the maximum possible extent. Most of them represent security problem considerations associated with other prior bank building programs.

## 20. ENVIRONMENT

- a. Neighborhood It is desirable that the building be located in a community that is relatively free from rowdy establishments, high criminal activity, and probable civil disorders.
- b. Access streets should be so arranged and connected to main thoroughfares that persons and vehicles having business with the bank (including police and fire assistance) can come and go easily. Review traffic flows, driveways, and related factors with the city traffic engineer early in the

- i. Police services Is there a well staffed police station near the proposed building location and do the police make periodic patrols through the area? Will the police accept alarms and/or direct line communications from the bank?
- j. Fire services Is there a city fire station nearby and does it have the type of equipment that might be required in the event of a serious fire in the proposed building? Be sure and check with the local fire prevention authorities. At an early stage of development, plans should be reviewed with fire department officials and the building inspector's office to forestall any serious security or safety conflicts.

## 30. BUILDING PERIMETER

- a. Building walls should be designed so that they would not be easy to climb.
- b. Low level windows It is desirable to minimize windows located less than 18 feet above the ground or easily accessible projections. If any are, they should be heavily barred or otherwise equally protected.
- c. Riot barriers Any low level windows or transparent areas of entrance panels and doors should be glazed with penetration and fire resistant material. Metal doors, grills, or other riot protection features should also be provided for any entrances and low level windows that are not characteristically strong.
- d. Air vents and other openings It is highly desirable that vents be not located at ground level nor lower than 18 feet on the building walls. All vents should at least be covered with a heavy expanded metal grill, and any that are quite vulnerable should be covered with strong bars. In highly vulnerable situations alarm or television surveillance should be added.

- e. Public utility connections Public utility vaults and accessory pits should be located outside the building if possible, with no connecting passages large enough for persons to pass through. Pipes and cables should enter the building through the smallest sized conduit permissible. Manhole entrances to nearby utility vaults and pits should be equipped with locks and alarms. If grate or grill covers are used over such vaults or pits, they should also be firmly fastened or locked in place.
- f. Roof protection Windows opening on the roof should be covered by expanded metal grills or bars. Roof access doors should be strong and equipped with rugged locks and alarms. A door bell should be provided for benefit of any person who might become trapped on the roof. A water hose connection should be available at the roof level to facilitate fighting a roof fire or wetting down the sides of the building in the event of an adjacent building fire. In buildings that have roof heliports or large open roof areas where a helicopter might land, the access from the roof to the interior of the bank should be physically as well protected as the access at the ground floor level.
- g. Outside access to upper walls and roof If there are low level roofs, balconies, or other characteristics of the building that might facilitate covert access at higher levels, barriers should be installed at all vulnerable points or appropriate surveillance by alarms or television should be provided.
- h. Outside lights All adjacent ground areas and any vulnerable wall and roof areas should be illuminated during the hours of darkness, so that there are no dark areas where a person could hide or maneuver. If parking lots are to be used after dark, they should be adequately lighted, and if they are located in crime prone areas, it may be desirable to provide for guard or television surveillance.
- i. Perimeter fences or walls If there are lawn, garden, parking, or plaza areas on the property where controlled or restricted public access is desirable, consideration should be given to enclosing such areas with walls or fences. These could be decorative and still have protection value. Entrance gates or doors to such areas could be remotely controlled if needed.

j. Perimeter surveillance - It is desirable for the guards to have some knowledge of conditions on the outside of the building at all times. This may be accomplished by providing some of the guard posts with an outside vision capability, locating guard patrol stations so the patrol guard can look out windows on all sides from time to time, or making provisions for outside television.

## 40. BUILDING LAYOUT

- a. General From a protection standpoint it is advantageous to compartmentalize and segregate the high risk functions from other activities in the building. Since the security court and the vaults are usually at ground level or below, it is generally best to set aside the lower portions of the building for the high security functions. If possible, all such functions should be grouped together behind protective barriers on one or several floors. Non-security employees should neither work in nor have unnecessary access to the .security areas. The number of entrances and exits should be kept to a minimum, and all should be guard controlled. Teller, windows and currency exchange rooms should be available at the perimeter of the high security areas so that business with outsiders can be transacted without permitting them to enter the protected area. If the high security activities are well segregated and well controlled, it is usually permissible to operate the remainder of the building as conventional office space with a much lower level of control and protection.
- b. Elevators Passenger and freight elevators, exclusive of security elevators, should not unnecessarily open into security areas. If it is necessary to have one or more elevators stop in security areas (such as a freight elevator), they should be key controlled or otherwise have highly controlled access to such areas. Consideration should be given to having all security elevators manual or key controlled.

- c. Stairs and evacuation routes Every effort should be made to locate emergency stairways and fire evacuation routes so they will terminate adjacent to a service entrance and not require the installation of an additional outside door. All stairways and entrances connecting secure areas with non-secure areas should be controlled by guards.
- d. Number of outside entrances Generally the optimum number of Bank entrances will be five. If possible, the number of entrances should be limited to not exceed the following:
  - Banking entrance
  - Employee entrance
  - Security court entrance
  - Delivery entrance
  - Employee parking garage entrance
- e. Banking entrance arrangements It would be advantageous if the banking entrance and floor could be arranged so that all pedestrian bank business (including bank foot messengers) could be transacted at that location and thus have minimum traffic to other floors or locations.
- f. Employee entrance arrangement This entrance should be arranged so that large numbers of employees or bank visitors can be quickly identified and cleared during business hours, and so that the door can be easily locked and unlocked for after hours pedestrian traffic.
- g. Security court entrance arrangement The security court should have an entrance control chamber with an interlock feature on the sequential doors or gates. The control chamber should be designed to facilitate inspecting the interior of vehicles with minimum exposure of guards to danger. Provision should be made so that both sets of doors or gates could be opened at the same time if necessary to admit a very large vehicle. Guards controlling such entrances should have a vision capability both inside and outside the entrance. Exterior entrances leading into the security court should not be unlockable by a person on the outside.
- h. Delivery entrance arrangement It is undesirable to combine delivery entrances or docks with the security court entrances or docks. Either the security court or the delivery court should be designed to facilitate the unloading of large semi-trailor type coin delivery trucks. The dock, doorways, and hallways should accommodate the power forklift movement of coin loaded on pallets.

- i. Public related activities Protection problems are reduced if public related activities, such as, personnel, purchasing and the public lobby, are located near the public or employee entrances so that visitors to these departments will not need to go to remote areas of the building.
- j. Rest rooms Rest rooms should not be located in vaults; however, they may be located inside security areas. Employee lockers should not be located inside security areas. Non-security employees should not need to go inside a security area to find a convenient rest room. Employees from one department should not need to pass through the work areas of another department to reach a rest room. Rest rooms should be provided in the security court for armored truck personnel and adjacent to the public lobby for official visitors.
- k. Mechanical rooms Insofar as possible, mechanical rooms should not be located inside high security areas and mechanical personnel should not need to pass through security areas to reach such rooms.
- 1. Package control facilities Consideration should be given to providing a storage room or lockers for package control use near the building employee entrance and adjacent to high security area entrances.
- m. Location of guard space Normally guards should have the following space.
  - (1) A heavily protected guard control room. If this room is located adjacent to the employee lobby or night truck entrance, the control guard may be able to help supervise one of these areas, through the use of remote controls, during after hours periods.
    - '(2) An office for the chief guard and, if needed, an administrative office. These rooms should be located near and closely associated with the control room.
    - (3) A guard squad room with associated rest room, showers, lockers, and efficiency kitchen. There should be secure containers for heavy weapons located in this space. The entrance door should be designed and equipped with hardware so that only authorized persons can enter. This space should be located so

that reserve guards can respond quickly to the areas of greatest potential hazard. The space should be arranged and comfortably equipped so that reserve guards can be expected to generally be available there when not otherwise assigned.

- (4) A training room. This room should be adjacent to the squad room so that reserve guards can be given training and still be quickly available for emergencies.
- (5) An indoor target range, This facility could be located at any available location. However, it should not be near vaults or work areas where the noise might disturb sonic alarms or working people. If it is possible to locate the range near the squad room, the reserve guards might also be given this training while on standby.

n. / Guard posts - As a minimum, guards should directly control all activity at the building entrances and at the entrances to high security areas. Usually this requires the establishment of a guard post at each of these locations. However, if the volume of traffic is low, and only employees are involved, it is sometimes possible to adequately control an inside entrance or exit through the use of special barriers, electric locks, card or key door activators, intercommunication systems, closed circuit television, or similar supervised devices. It is highly desirable that all guards who directly control access or exit from high security areas be protected by armored booths located adjacent to entrance control compartments that have sequential operating doors. All guard posts should be located where they will have unrestricted view of the areas and activities for which they are responsible. In general, if the facilities permit effective control of the building entrances and if the control over traffic to and from the high security areas and the vaults is quite impregnable, it is often feasible for the traffic within these areas to be controlled by responsible department heads, providing each area is appropriately designed and equipped. Further, if persons entering the building are well screened and all security activities are segregated and protected in the lower areas of the building, the upper floor office space will not usually be in enough danger to warrant the establishment of occupied guard posts in such areas.

Guard services constitute a costly recurring expense; hence, whenever it is possible to reduce the need for guards without detrimental effect on security or bank operations, it is desirable to do so.

- o. Civil defense fallout shelter A fallout shelter shall be provided for protection of the normal population of the building. (For details see Z letter #5296, dated July 13, 1961 and Technical Memorandum 61-3, revised August 1964, issued by OCDM)
- p. Currency destruction If possible, the unfit currency verification, cancellation, and destruction operations should be conducted inside the security areas. The incinerator or other destruction equipment room should have a sturdy door equipped with a good lock and an alarm. The equipment should have a high level of destruction efficiency, a hasp for dual locks on each door or vent, and a small mesh screen over any vents. Pollution control features should meet the requirements of local codes.
- q. Fire barriers Fire doors should be provided on all fireproof stairways, and fire barriers should be installed in other appropriate passages or ducts. Combustible materials should be avoided to the maximum extent in partitions, ceilings, insulation, and furnishings.
- r. Portable fire equipment Provisions should be made for installing the proper types of fire extinguishers and other fire control equipment at strategic locations on each floor.
- s. Emergency valves and switches Control valves or switches that may need to be turned on or off in the event of a serious emergency should be conveniently located and clearly labeled.
- t. Cabinets and closets in high security areas It is desirable to eliminate, as far as possible, built-in enclosures of any type that might become a hiding place or clutter receptacle in rooms where money or other valuables are processed or stored.
- u. Security related activity space Security related activities, such as fingerprinting and the processing of credentials, are usually more easily handled if a conveniently located and specially equipped room is provided.

- Tenants If space is to be rented to tenants, it should be consolidated and segregated from the bank activities as much as feasible. Stairway doors to such areas should be locked with panic bar locks, clearly labeled "Emergency Use Only," and alarmed. If possible, one or more public elevators should be programmed for nonstop service between the entrance lobby and tenant space only. If it is desired to allow unscreened access by the tenants and their visitors during business hours, the entrance and tenant elevator lobby should be designed so that such persons can proceed directly to the tenant elevator without passing through the screening process provided for bank employees and visitors. Patrol key stations should be provided for guard patrol of the tenant area during after hours periods. Any alarm systems or other extensive security facilities desired by tenants should be approved by the bank protection department and inte-grated into the overall bank security program. Consideration should be given to the very restricted types of potential tenants that are acceptable and available so that any predictable requirements they may have can be considered in designing the facilities.
- Permitting groups of persons, of superficially known character or conscience, to have extensive access to high security areas or computer areas is both dangerous and potentially disruptive. A first hand observation of such facilities and protection procedures would be invaluable to criminally minded persons and there might be an opportunity for disruption or destruction by militant persons. An alternative might be to construct a conveniently located exhibit room. Items of interest could be exhibited together with projected moving pictures or slide and closed circuit television of selected views from several locations in the bank. If this is not acceptable, attempts should be made to provide observation stations where visitors could view selected areas without revealing too much about the protection measures or providing an opportunity for improper conduct.

## 50. CONSTRUCTION

# a. Security barrier construction

- (1) For very high risk areas (such as important guard enclosures) the following minimum standard guidelines should be used:
  - (a) Glass Two-inch thickness Pittsburgh Plate Glass Company high power multiplate type or equivalent.
  - (b) Steel Mild steel Brinnell hardness 140, one-half inch thick 22 lbs. per square foot weight, or

Armor plate - (High hardness steel MIL-S-46100) one-fourth inch thick - 10 lbs. per square foot weight.

(c) Concrete - Six inches thick - Reinforced - 2,500 lbs. per square inch, minimum compressive strength.

(These combinations of bullet resistant materials will protect against high powered rifles using ball type ammunition.)

- (2) For moderately high risk areas (such as, money processing and other internal security area barriers) the following minimum standard guide-lines should be used:
  - (a) Glass 1-9/16 inches thick Pittsburgh Plate Glass Company hi-resist multiplate type or equivalent.
  - (b) Steel Mild steel Brinnell hardness 140, 3/8 inch thick 17 lbs. per square foot weight, or

Armor plate - (High hardness steel - MIL-S-46100) 1/4 inch thick - 10 lbs.

(c) <u>Concrete</u> - Four inches thick - Reinforced - 2,500 lbs. per square inch, minimum compressive strength.

(These combinations of bullet resistant materials will protect against revolvers and other handguns.)

- (3) For protection against riots, fire bombs, thrown bricks and similar hazards a laminated penetration resistant glass should be considered.
- (4) Security walls of all types should extend from the floor slab to the ceiling slab. Door hinge pins should be welded in place. Screws and bolts holding protection facilities in place should not be removable from the outside.
- (5) <u>Barrier doors</u> should not have master keyed locks. Electric locks should be sturdy and the latch bolt should be made of metal.

### b. Guard enclosure construction

- (1) The guard control room should be heavily protected and arranged so that a minimum number of persons need enter or occupy this space. It should be provided with air conditioning 24 hours per day, 7 days per week. Lighting and furniture should be comfortable as well as practical. A light dimmer control has value.
- (2) All guard enclosures should be equipped with gun ports. The port opening, if in glass, should be at least 3 inches in diameter and the closing plate should lock in both the open and closed positions. Gun ports installed in armored booths can permit a wider angle of weapons use if constructed as a 1-1/2" x 6" slit in metal plate mounted immediately below the glass area. The opening can be covered by a small door that can be locked when closed. The ports should be located on all sides of the enclosure where danger might arise and they should be installed high enough and convenient enough for the guard to use them without having to assume an unreasonably awkward position. (Height from floor 3-1/2 to 4-1/2 feet) Ports should be as small as practical consistent with the characteristics of guard weapons and the area to be covered.

- Guard turrets should be air conditioned and should contain all necessary communications, alarms, controls, and emergency equipment needed for the guards to perform their duties without opening the turret doors or windows. Turrets that have a window facing outside the building should protrude a few inches and have side panes which permit vision and use of weapons along the sides of the building. Consideration should be given to installing tinted glass or other glare protection features in windows facing outside. If such turrets are occupied at all times, they need not have riot shutters or covers. Those that are not occupied should have protective covers which are operable from inside the turret. Since guard turrets are frequently rather small enclosures, it is desirable to mount a layer of a transparent plastic, such as "Zelux-C" inside the glass panels, to better protect the guards from glass splinters in the event very powerful attack weapons are used. Two inch bullet resistant glass backed up by one-half inch of "Zelux" for outside turret windows and 1-3/16" B.R. glass with 1/2" of "Zelux" for inside turret or teller windows is recommended. Turrets should be provided with a writing shelf and cabinets for storing gas masks, heavy weapons and other reserve equipment and supplies. If papers, guns, or other physical objects are to be exchanged with a turret guard, a suitable protected pass-through facility should be provided.
- (4) Guard enclosure lights, ventilation, and electric power operated security equipment should be automatically connected to the emergency power source in the event of a power failure.
- (5) A protected means for gaining access to all guard enclosures should be provided in case the guard on duty became seriously ill or inadvertently locks himself out.

- (6) Spare conduits a reasonable amount of unused power and signal wire conduit capacity should be provided in security enclosure walls for future needs. If there are security doors or other security facilities that may not need alarms or electric controls at the time of construction but are likely to need them at a later date, it is usually advantageous to imbed the needed conduit and terminal boxes in any masonry walls, floor or ceiling slabs at the time they are constructed.
- (7) Consideration should be given to rheostat control of light levels in guard, enclosures.
- c. Teller windows These facilities should be constructed of bullet resistant materials and if sizable quantities of valuables are to be exchanged with non-bank personnel, an auxiliary protected pass-through capability should also be provided. The teller window should be designed so that voice communication between the two sides is not difficult.
  - d. Indoor weapons range A weapons range should be provided and should include the following characteristics:
    - (1) The range should be located in a portion of the building that is conducive to safety. The range perimeter should be constructed of heavy masonry and there should be no doors or other openings down range through which a bullet or fragment might escape from the area.
    - (2) Only equipment produced by a manufacturer with long experience in this field and a reputation for producing excellent range equipment should be used.
    - (3) Enough shooting positions should be provided (a minimum of two) for each guard to receive training monthly. Shooting positions at least 42 inches wide are recommended.

- (4) The bullet trap should withstand at least the impact of a 300 grain bullet at a velocity of 2,400 feet per second. It should be designed to provide the highest possible degree of safety and all surfaces between the firing line and the backstop wall must be safeguarded so they cannot cause ricochets or fragments to be directed toward the shooters.
- (5) The effective length of the range should be a minimum of 50 feet.
- (6) The shooting stall partitions should prevent penetration and harmful ricochets of direct fire of 38 caliber ammunition from an adjacent stall.
- (7) Special ventilating and lighting will be needed and some acoustical insulation should be considered. Rheostat control of target light level is desirable.
- (8) An individual target transport mechanism should be provided for each shooting position. The transports should be individually controlled, should permit stopping the target at intermediate points along the track and should have provisions for target turning.
- (9) The design of the range and equipment should be such that it will accommodate some practical shooting, i.e., double action, sitting, prone, etc.
- (10) A range officer timer, control, and audio command system should be provided.
- (11) Consideration should be given to constructing a room at the rear of the range, with large windows glazed with 1-9/16 inch bullet resistant glass, for the use and protection of the range officer and visitors.
- (12) Space and equipment should be provided for the storage of ammunition and for the cleaning and storage of weapons.

(13) The entrance door should have an alarm and the range should have an intercom station connected to guard control.

## e. Vault construction

## (1) Vault usage

- (a) General purpose vaults must be maximum security vaults.
- (b) Maximum security vaults shall always be used for the storage of negotiable valuables, such as: currency, main stock of securities (other than savings bonds), bullion, and items held in safekeeping.
- (c) Intermediate security vaults may be used for the general storage of coin, Treasury checks, savings bonds, canceled currency, canceled securities and other valuables of similar risk. When significantly advantageous from an operating standpoint, such as, minimizing movements of securities between points of receipt, processing, storage, ultimate disposition, etc., a minimum amount of securities (such as the amount necessary to continue processing after the maximum security vaults have closed in the afternoon) may be stored in an intermediate security vault overnight, but not over weekends or holidays.
- (d) Book vaults shall not be used to store valuables of any kind.
- (e) Maximum security vaults should generally be located on the lower floors and near the principal entrance for the receipt and shipment of valuables. Intermediate security vaults and book vaults may be located for convenience on any floor. However, intermediate security vaults should not be constructed in space that might later be needed for maximum security purposes. In other words, in cases where the possibilities for future vault construction are limited, it would be preferable to construct a vault

originally intended for coin to meet maximum security specifications, and thus be able to accommodate unforeseen future need for maximum security space; rather than to save on the initial cost by constructing an intermediate security coin vault and thereby be precluded from meeting a need for additional maximum security vault space.

## (2) Maximum security vault construction

- (a) The perimeter walls, floor and ceiling of maximum security vaults shall be 18 inches thick and shall be constructed of vertical system steelcrete or equivalent, having a concrete strength of 3000 psi.\*

  In multifloor vaults the intermediate floors shall be constructed of high load-bearing concrete with normal reinforcing. Vault floors resting on rock, where the effective protection is equal to 18" steelcrete, can also be constructed of normally reinforced concrete.
- (b) Vaults shall normally have two doors, one of which shall be an emergency door. Normally the clear opening of the main door shall be 84" x 48" and the emergency door shall be a minimum of 30" x 30".
- (c) Yault ventilating ports may be used if the closure device is equivalent in strength to the vault walls. However, vaults of large size may require so much fresh air that it is more practical to use the emergency door and air directing plenums or ducts.
- (d) Conduits for power, alarm, and communication wires should not exceed 1-1/2" in diameter and have at least one 90 degree turn with drainage to the exterior. Normally the ends of conduits shall be sealed to prevent moisture, gas, or other undesirable substances from getting into the vaults. Each vault should have a telephone or an intercom station that can be used in the event of an emergency.

- (e) Pneumatic tubes may be used to transport valuables to and from the inside of the vault provided that a removable section of tubing is used to extend the system through an existing vault door or that it passes through a closable vault wall air lock that is equal in strength to the vault walls.
- (f) In some past instances vault interior partitions have been unsatisfactory because of inadequate specifications. Such features as closeness of bars or grill work, sturdiness, firmness of anchoring and partition locking facilities shall be specified and shown in detail.
- (g) Vault walls may be located in close proximity to building walls but should be entirely separate from them. They should never be used as principal load-bearing building walls. They should have separate footings and properly designed expansion joints. The efficiency of modern vault protection devices makes it unnecessary to provide special viewing areas around the outside of vaults except in situations of unusual risk.
- (h) Vault floors shall be level with the adjacent building floors to facilitate the movement of trucks and buses.

\*NOTE: A steel lining shall not be used in lieu of concrete for the maximum or intermediate security vaults.

- (3) Maximum security vault doors The following specifications are recommended:
  - (a) The vault doors shall have an effective thickness of 16 inches, with the actual thickness beyond that being minimal, consistent with requirements of space for locks, bolt work and other necessary features.

- (b) The clear opening of the principal vault door shall normally be 48 inches wide and 84 inches high. The protective jamb shields may reduce the width by not more than three inches.
- (c) The doors shall be designed to have a frame which will grip an 18 inch steelcrete reinforced wall. The vault door manufacturer shall furnish plans specifying detailed requirements of the vault construction that are necessary for proper installation of the doors.
- (d) The vault door frames shall be securely fastened to the steelcrete wall by welding connecting bars between the exterior surface of the frame and the reinforcing rods projecting into the wall opening. These reinforcing rods and any auxiliary door frame attachment members required by the vault door manufacturer shall be installed by the general contractor prior to pouring the vault wall.
- (e) All grouting required around the vault door frame and mechanism should be included in the work to be performed by the general contractor rather than by the vault door manufacturer.
- (f) The door sill shall be designed to accommodate fork lift and hand truck traffic and to support a load of 8,000 pounds.
- (g) The door jambs shall be protected by shields up to a minimum height of 40 inches above ≪ the sill.
- (h) The door hinges shall be designed and constructed to keep the door in precise alignment with the frame at all times and shall have low friction bearings.
- (i) A suitable door stop shall be installed to locate the door in proper open position.

- (j) The vault door and frame shall be fabricated in accordance with the manufacturer's best standard practice, to form solid integral units. The locks (time locks and combination locks) shall be located in the door frame and the frame section guarding the locking mechanism shall have the same effective thickness and lay up as the vault door. The door slab and the frame section guarding the locking mechanism shall be further protected by dual closed circuit alarm wires, arranged 2" o.c., and with appropriate contacts and alarm wiring connection points. The lay up of protective materials for the door and appropriate frame sections shall be approximately as follows:
  - 6" open hearth steel
  - 8" burn resistant cast iron
  - 2" monolithic tool and torch resistant material
  - Space for alarm grids
  - Finish plates on free and back
- (k) A stainless steel by gate, with suitable look, shall be so tiled.
- gate may be provided with a power driven opening and clouds feature. However, if this feature is desired it should be provided for in the specifications which should additionally provide that it shall be possible to open or close the door or page manually in case of a power failure.
  - (m) The bolt work shall consist of inter-)
    locking splines and/or locking bars, and/or bolts
    which lock the door slab strongly to the door
    frame along the full height of the door.
  - (n) The work connections to the locking controls shall be protected by a relocking device that will activate in the event of external attack.

It is to function if penetration is made in any critical area by torch, explosives or mechanical means.

- (o) The door shall be controlled by two four-tumbler combination locks. The dial numbers shall have a shield to restrict visibility of the numbers to the operator only. It shall be possible to check the movement of the locking mechanism in conjunction with the time lock control.
- (p) A four-movement, 120 hour time clock having an inside emergency release feature shall be furnished. There shall be an easy means of determining when the clock is wound and when it is run-down.
- (q) Finishes, cladding, and trim shall be in accordance with the manufacturer's style and common practice for a door of the type specified. The panel covering the rear mechanism of the door lock shall be opaque.
- (r) The emergency vault door shall normally have a clear opening of 30" x 30" and a combination locked manually operated day gate. All other appropriate features specified for the main door are applicable to the emergency door.
- . (s) The door contractor shall submit in advance exact specifications, drawings and information on the characteristics and appearance of the doors and related equipment to be furnished. This will include any requirements or conditions for which the general contractor is obligated.

## (4) Intermediate security vault construction

(a) The walls, floor, and ceiling of intermediate security vaults shall have not less than 12 inch thick concrete, with a minimum strength of 3000 psi, and shall be reinforced by at least two grids of deformed, Number 5, steel bars, or other appropriate steel, placed parallel to the face of the walls, weighing at least 6 pounds

per square foot to each grid and having an open area of not more than four inches on center in both the vertical and horizontal directions. Grids are to be located not less than 6 inches apart and staggered in each direction.

(b) Other features for intermediate security vault construction (including alarms) should be the same as for maximum security vaults, to the extent applicable.

## (5) Intermediate security vault doors

- (a) Vault doors shall have an effective thickness of not less than 7 inches of metal including monolithic torch and drill resistant material used to protect the locking controls and equipped with dual combination locks and at least a three movement time lock and alarms.
- (b) Other features specified for the maximum security vault doors shall be used to the extent applicable.

## (6) Book vaults

- (a) Book vaults that may be used to store computer tapes should have at least a four hour Underwriters' Laboratories fire rating. This would require that the walls, floor, and ceiling be constructed with a minimum of 8 inches of reinforced concrete or 12 inch brick walls, or an equivalent material, and a four hour fire resistant insulated vault door. The vault should be equipped with an ionization type fire detector system, alarm activated water sprinklers and an alarm activated magnetic door release.
- (b) Book vaults for storage of records should have at least a two hour Underwriters' Laboratories fire rating. This would require that the walls, floor, and ceiling be constructed with not less than 6 inch reinforced concrete or 8 inch brick walls and a two hour rated insulated vault door.

- (c) Both types of book vaults should be equipped with door alarms.
- f. Vault lobbies If access to the vault area is well controlled and protected, consideration should be given to having a non-guard supervised access to the vault. It may be possible for the vault custodian or other appropriate employee to do this by remote control of the day gate in connection with his regular job if the vault lobby is designed so that he can observe and converse with persons desiring to enter or leave the vault. If vault traffic is heavy, it may be economical to use a magnetic card or key for persons to indicate identity and the desire to enter. Use of the card or key could also automatically be recorded for the required vault entrance-exit log.

### g. Computer facilities protection

- (1) The great value of computer equipment, programs and data, and the critical necessity for uninterrupted computer operations in Federal Reserve Banks makes it essential that effective protection measures be taken.
- (2) Both the data processing computers and the check processing computers shall be segregrated from all other equipment and activities by sturdy partitions. Any glass portions of partitions shall be glazed with laminated riot protection glass.
- visitors to view computer operations through glass observation windows in the walls of the computer equipment rooms. An alternative might be the use of closed circuit television with a remote monitor.
- (4) Provisions shall be made for strict control of employee access to computer equipment areas. This can usually be accomplished through the use of cipher or coded identification card key locks on all entrance doors. Secure night locks shall also be provided on all doors for control of unauthorized access during non-operating periods.
- (5) Each computer area shall be equipped with an ionization type fire fume detection system which annunciates both in the computer area and at guard control.

- (6) Carbon dioxide fire extinguishers, or other approved types, shall be provided in the computer equipment areas.
- (7) There shall be convenient vaults or safes which have a four Insurance Rating Board fire resistance for protection of software. The vaults shall have ionization fire detection and if practical shall have an automatic carbon dioxide fire extinguishing system.
- (8) If the bank contemplates the installation of "time sharing," or other computer equipment, where the peripheral input and output devices can be in remote locations, consideration should be given to providing a specially designed book vault for housing the main processing equipment with accessories and memory units.
- (9) Data transmission lines and computers radiate information in the form of electromagnetic energy which can be intercepted and interpreted with appropriate equipment. If highly confidential information is to be frequently processed, it may be desirable to locate the computers and transmission lines as remotely as possible from tenants and any other possible eavesdroppers, or provide electromagnetic shielding for the equipment.
  - (10) Computer equipment and installations should equal or exceed in quality the published standards of Underwriters' Laboratories, Inc.

h. Fire protection facilities - As a minimum, the following fire protection facilities should be considered:

	Area	Protection Facility
(1)	Computer area	Ionization type detectors
(2)	Vaults (inside and out)	Ionization type detectors
· <b>(</b> 3)	Stove hoods in kitchen	Automatic CO <sub>2</sub>
(4)	Paint spray booths	Automatic CO2-
(5)	Inflammable storage areas	Sprinkler or rate- of-rise detectors
(6)	Maintenance shops	Sprinkler or rate- of-rise detectors
(7)	Garage areas	Sprinkler
(8)	Furnace and incinerator rooms	Rate-of-rise detectors
(9)	Any other high hazard areas	One of above

i. <u>Door locks</u> - Door locks should be rugged and tamper resistant. It is desirable that all locks, and essential that the more important locks, have a dead-latch feature. Locks on ordinary doors can be master keyed. Locks on building entrances,

high security entrances, and entrances to other highly restricted areas should be individually keyed. Areas where access is highly restricted at all times may be more effectively controlled if equipped with remotely operated electric locks or power door mechanisms. Magnetic card locks and coded push-button locks have some advantages for certain unusual requirements. The protection department should be provided with a key cabinet and related facilities for maintaining effective control over all locks and keys.

### 60. ELECTRIC POWER AND LIGHTS

- a. Power supply It is desirable for the building to have at least two primary electric feed lines, either of which can handle the entire building load. If possible, these lines should connect to separate power substations or to a power network. There should be duplicate transformers and power switch panels with automatic transfer of load relays to meet needs in the event of a partial power failure.
- b. Emergency power An engine driven emergency generator should be available and of sufficient capacity to at least operate the following equipment in the event of a total power failure:
  - (1) Security doors
  - (2) Emergency lights
  - (3) Security elevator
  - (4) Water pressure booster pumps and pumps on any fresh water wells
  - (5) Security communication and television systems
    - (6) One passenger elevator at a time to free persons that might be trapped

- (7) Fallout shelter
- (8) Computers and computer air conditioning
- (9) Backup power for alarms, telephones, etc.
- (10) Any other essential equipment

The emergency generator should start and pick up the emergency circuit electric load automatically upon failure of the normal power supply. Sufficient fuel should be stored below ground outside the building to provide all emergency power for one week and/or provide power for the fallout shelter for two weeks.

c. Building lights - The normal building lighting should not result in dark areas where it is hazardous to work or move about. Sufficient lights should be left on at night to permit safe movement on all floors and to facilitate inspections by the guard on building patrol. Special lighting as specified by a television engineer should be provided in areas to be covered by closed circuit television. In some very critical areas emergency battery powered, automatic, lanterns should also be considered.

## 70. HEATING AND AIR CONDITIONING

- a. Fresh air supply vents Effort should be made to locate the building fresh air intake vents high enough above the ground to make intentional or accidental air contamination unlikely.
- b. Auxiliary air conditioning facilities Special air conditioning and heating units should be provided for computers, guard control, the guard squad room, and any guard post turrets that will be occupied continuously. The air intake for these units should be highly protected. If it is not possible to operate appropriate main building heating or cooling equipment from the emergency generator, it would be desirable to provide some special air handling equipment for the fallout shelter and

any other areas that may be required to operate during emergencies.

c. Fire protection in mechanical equipment - Large motors, furnaces, and other similar equipment that may overheat should be equipped with heat detectors that will either shut down the equipment or sound an alarm or both.

### 80. WATER

- a. City supply The water supply should be adequate in volume and pressure to permit the fighting of fires on any floor for an extended period. If pressure is marginal, or is apt to be low because of fire fighting in other areas of the city, booster pumps and a stored reserve supply of water should be considered. A reserve supply located at the top of the building may be of value in the event both the electric power and city water supply are inadequate.
- b. Fallout shelter supply Water for human consumption during emergencies should be available either from circulating fresh water tanks or fresh water wells. Suitable pumps and control valves will be needed to feed this water to the appropriate areas.
- c. Emergency pipes Water supply standpipes should be installed at convenient locations and extend the full height of the building including the roof and any penthouse structures. There should be valves and hose connections (the hose connection adapters should be compatible with the couplings on the fire department hose) at each floor level. If it is decided that hose not be located on racks and attached to the standpipe valves, consideration should be given to having several lengths of hose stored at convenient locations in the building. Outdoor siamese connectors should be attached to the standpipe system for fire department use. Automatic sprinkler systems, equipped with alarms, should be installed in all areas of unusual fire risk where water would be a suitable extinguishing agent.

### 90. COMMUNICATIONS

- a. Bank telephones The bank telephone lines should run through conduit or other protected enclosures and the junction boxes should be lockable and located in lockable wire closets. The switchboard and frame rooms should be constructed as protected areas with doors that are locked and alarmed.
- b. Emergency telephone communications for guards The guards should be provided with at least one highly protected outside telephone. Preferably it would be a direct line to the police and/or fire department. If this is not practical, a dial phone would be acceptable. The emergency phone wires should not be part of the regular phone system, but rather should exit from the building by the shortest and best protected route possible and should be safeguarded if they appear in any accessible telephone company manholes or outside junction boxes. During after hours periods a backup emergency communication link would have value. This might consist of a periodic telephone check with the police or some other reliable organization, or a timed switch which must be deactivated periodically to prevent it from transmitting an alarm signal.
- c. Public address system If a public address system is to be installed in the building, it should be designed so that it can be heard in all areas of the building, including rest rooms, machine rooms, storage areas, etc. Such a system has advantages over alarm bells for fire evacuation, civil defense evacuation, and other employee instructions or alerts. It can also be used to provide music throughout the building. If this feature is added, the wiring must be arranged so that if the loudspeakers are turned off or decreased in volume an override capability will restore them to full volume when a public address announcement is made.
- d. Intercommunication system A security intercom system should be provided. The principal master station would be located in guard control. The following other stations should be considered:
  - (1) Chief guard's office
  - (2) Guard squad room
  - (3) Pistol range

- (4) All stationary guard posts
- (5) Remotely controlled doors or gates
- (6) Building engineers' office

Intercom connections between guard posts cooperating on the same protection activity are often advantageous and they may be useful for guards remotely controlling
equipment or persons. The control room guard should be able
to call selected stations or all stations simultaneously.
Each substation should be able to signal the master.

- e. Employee warning alarms If a public address system is not to be used for fire and air raid alarms, an extensive system of warning bells or horns, with a loud and unique alarm for each type of emergency, should be provided.
- f. Two-way radio A two-way radio system should be provided as follows:
  - (1) A central station with the console located in guard control and a strategically located remote antenna. The transmitting power may vary between about 30 watts and 125 watts depending on location and use requirements.
  - (2) Mobile units in bank security vehicles. These may operate at about 60 watts of power.
  - (3) Hand carried portable units. These should generally radiate power in excess of 1/2 watt. Enough units should be obtained to equip all guards that are on duty and are not assigned to a location equipped with an intercom station. Rechargeable batteries and battery charging equipment are usually more economical than using the throw away batteries. Leather carrying cases with shoulder straps are desirable.
  - (4) All radio units should be designed and adjusted to operate on the Federal Reserve assigned FM frequency in the 413MHZ band. The exact frequency assignment should be obtained by communicating with the Board's Division of Federal Reserve Bank Operations.

(5) In jurisdictions where permitted a backup radio link with the local police has merit. Radio equipment is available that idles in a completely dormant status until activated during an emergency.

### g. Closed circuit television

- (1) Closed circuit television is a versatile protection tool and should be used wherever it is advantageous. Some typically useful applications are:
  - (a) Surveillance of activity outside building
  - (b) Outside of security court entrance and exit doors
  - (c) Interior or exterior surveillance of vaults
  - (d) Remote control of doors and gates
    - (e) Shrverllance of building entrances
    - (f) Surveillance of high security areas
  - (g) Surveillance of vulnerable roof or balcony areas
  - (h) Remote viewing for public tour groups
    - (i) Vault entrance control
  - (j) For safety of persons in garages or other risk areas
    - (k) Remote inspection of credentials
    - (1) Surveillance of public and employee lobbies
    - (m) Surveillance of security court and freight docks

- (n) Surveillance of elevator lobbies
- (o) Monitoring remote areas of the building in lieu of periodic guard patrols
- (p) Recording of pictures in accordance with the specifications in Regulation P
- (q) Protection of nearby annex buildings or space
- (2) Transistorized cameras and monitors usually have a longer life and are more trouble free than vacuum tube types.
- (3) Monitor screen size is largely a matter of personal preference. Optimum viewing distance is approximately four times the picture height.
- (4) Television systems are complicated and therefore advice on illumination, optics, system characteristics, and equipment placement should be obtained from a closed circuit television expert rather than relying on a product salesman or trial and error methods.
- (5) If recording of television surveillance of the banking lobby is to be done to comply with the specifications in Regulation P, a very carefully engineered system will be necessary. Conventional television recorders are quite limited in fidelity capabilities. The image generated by the camera must be very good to overcome this deficiency. Usually the head size or the television monitor must be in excess of one inch in height, and have a good resolution. for it to be subsequently copied satisfactorily by photographing the recorded playback on the television screen. This may be more readily accomplished by mounting the camera over the lobby exit so that persons to be recorded would walk toward the camera and their head and shoulders would be quite large on the television screen before they passed out of focus or out of view. The recorder could be activated by the holdup alarm system. The recorded playback portrait picture can usually be photographed satisfactorily by using the best quality polaroid land camera and a copying frame. The capability of video recording selectively from any of the television cameras has value. Video tape equipment is available for continuous recording of highly vulnerable location cameras.

- (6) If only occasional inspection of the camera screen is required, a single monitor may be provided with a selector switch for use with several cameras. However, most television surveillance activities are more effectively scrutinized if the picture from each camera is continuously reproduced. In other words it is usually advisable to have a monitor for each camera.
- (7) "Pan-tilt" mounting and "zoom lenses" are advantageous in some situations. Cameras mounted outdoors should have a protective housing.
- (8) Television equipment usually has a deterrent effect on potential wrongdoers and therefore should not generally be disguised or concealed.
- (9) Viewing of monitors is less fatiguing if a moderate amount of ambient illumination is maintained in the viewing room.
- (10) Equipment is available which will monitor a static television picture and signal an alarm if movement or other changes occur in the picture.
- h. Photographic surveillance If television is not to be used to meet Regulation P requirements, consideration should be given to providing photographic cameras for this purpose.
- facilitation for communication in the event of an emergency. Dial phones are not satisfactory because passengers can neither read the emergency number nor see how to dial it in the event of a power or elevator light failure.
- j. <u>Vault communications</u> Each vault should have a telephone or an intercommunication station that can be used in an emergency.

### 100. PROTECTION ALARMS AND CONTROLS

### a. Protection control console

- (1) A protection control console should be located in the strongly fortified protection control center.
- (2) The console should contain all alarm, communication, and control features in a single cabinet, so arranged that all functions can be conveniently observed and all controls reached by a single operator seated in front of the console. If desired, television monitors could be mounted in compatible racks above and behind the console, directly in front of the operator. Every effort should be made to design and arrange the console equipment so that it can be supervised at all times by a single operator.
- (3) All access doors or panels where unauthorized persons might tamper with or manipulate the functioning of the equipment should be provided with locks and alarms that record on the paper tape.
- (4) All of the alarm and communication systems should have a protected source of emergency electrical power.
- (5) All security circuits should run through solid wall conduit and junction points should be in locked wire closets.
- (6) It is highly desirable to have the same contractor provide and install the console and all related remote terminal equipment, and that he service the equipment indefinitely on a contract basis.
- (7) The installation contract should provide for furnishing copies of training and service manuals as well as initial training of all appropriate bank personnel.
- (8) All equipment should equal or exceed Underwriters' Laboratories standards.

- b. Robbery alarm activation devices should be considered for:
  - . (1) Each guard post
    - (2) Each lobby teller station
    - (3) Each high security area teller station
  - (4) The interior of each high security area where valuables are processed
    - (5) A location at or near vault entrances
- c. Administrative alarm (request for guard) activation devices should be considered for:
  - (1) Reception desk on executive floor
  - (2) Office of president and several other high level officers (If desired)
    - (3) Personnel Department employment section
  - (4) Any other location where the public might be directed routinely for service
    - (5) Each guard post
  - (6) Each private office adjacent to the banking lobby
    - (7) Reception desk at pedestrian entrance
- d. Burglary alarm activation devices should be considered for:
  - (1) Each vault. The devices should include wall vibration sensors, ionization smoke detectors (inside and out), door contacts and/or any other appropriate detectors.
  - (2) Any safe used for storing large amounts of valuables.

- (3) The location of alarm sensors shall be selected to the extent possible so that they do not interfere with the most efficient use of the space, i.e., do not mount a projecting sensor on a wall to be covered by stacked property. It may interfere with the stacking or may be inaccessible for adjusting and repair.
- e. Intrusion alarm activation devices should be considered as follows:
  - (1) Each building entrance door including elevator penthouse and any other roof top openings.
  - (2) Any other unguarded door or enclosure where control of access is needed during day or night periods.
- f. Fire alarm activation devices should be considered as follows:
  - (1) Fire pull-boxes at appropriate points on each floor
    - (2) Sprinkler and CO2 fire system alarms
  - (3) Ionization smoke detectors in computer and other highly sensitive areas
  - . (4) Heat detectors in areas constituting a high fire hazard and on or near machines that might overheat
- g. Employee evacuation warning systems should be considered as follows:
  - (1) A complete building public address system; or
    - (2) Fire bells or horns, and
    - (3) Air raid bells or horns

h. Guard patrol control system should be considered as follows:

- (1) Key stations in a sufficient number of locations to force guards to make a comprehensive coverage of the building on each patrol.
- (2) A programmer and paper tape recorder in the protection console to permit changes in the patrol times and routes, and make a record of guard compliance.
- i. Mechanical supervision As a rule, alarms on building mechanical equipment should connect to an engineer's console and a single signal be wired to the guard console to indicate when the engineer console is in a state of alarm. The protection console operator would communicate with an engineer or a reserve guard to have the trouble investigated.
  - j. Door controls should be considered as follows:
  - · (1) Remotely operated locks on outside doors to permit quick locking in the event of a holdup.
  - (2) Remote controls or locks for all doors under guard supervision.
- k. Surveillance photographic camera and/or television monitor and/or recording systems should be considered for all appropriate locations.
- 1. Communications systems should be considered as follows: (See Section 90 Communications)
  - (1) Intercom system between the protection console and the stationary guard posts. These should be of solid state design.
    - (2) <u>Telephone</u> at protection console and any guard posts where deemed necessary.
    - (3) Direct communication to police and fire departments from guard control console.
    - (4) Two-way radio with central station unit in guard control and sufficient portable and mobile units to meet needs.

- m. <u>Guard posts</u> should be equipped with a small wall or desk mounted console containing communication, alarm, television and control equipment needed to most effectively operate that post. Some equipment may require function transfer switches for remote handling of certain activities during periods when a post is closed. Some equipment should connect between posts or be duplicated at several posts and the control console for flexibility of operation.
- n. The selection and placement of protection equipment should not be attempted until the building plans are sufficiently complete that the entire protection activity can be planned. The scheduling of such hardware should be based on the respective protection requirements and the extent to which a particular protection aid will augment or replace other possible protection measures. A system analysis of the contemplated protection activity will help achieve an optimum relationship between personal services and hardware. The very high cumulative costs of personal services can usually be significantly reduced if maximum use is made of all other feasible protection measures.

OF THE TREASURY BUREAU OF MacDonald Room 2064

# Townsend and Bottum Engineering Company ENGINEERS AND CONSTRUCTION MANAGERS

April 27, 1972

Mr. Frank H. MacDonald
Deputy Director of The Mint
Room 2064 Main Treasury Bldg.
15th Street & Pennsylvania Ave. N.W.
Washington, D.C. 20220

Dear Mr. MacDonald,

I am writing to express an interest in the construction program for the proposed new U.S. Mint in Denver.

Townsend and Bottum Engineering Company would be interested in furnishing construction management services on the Denver Mint project on the basis that such services would be separate from a professional services design contract.

The service we would propose could be divided into two phases with the second phase being held as optional at the discretion of the Government:

Phase One: Construction Management During Design consisting of such items as constructibility
input to the design, budget estimate preparation, construction schedule preparation,
preparation of a contracting plan, etc.

Phase Two: Construction Management During Construction - consisting of development of bid packages, coordination of bidding process and providing field construction management.

I am enclosing two items to describe our capabilities and the type of program we would propose: (1) A brief description of Townsend and Bottum, Inc. and (2) A paper entitled "Constructibility Assurance During Design."

Townsend and Bottum Engineering Company is a subsidiary of Townsend and Bottum, Inc. providing professional services in the areas of design, consulting and construction management. The subsidiary supports the parent company in its extensive general construction business and draws upon the resources of the parent company in financial, manpower and facilities. While the majority of the Company's work has been in the utility field, it should be noted that a typical modern power plant includes large office and service facilities, cafeterias, machine shops, building service systems and a very large amount of production machinery erection that must be carefully integrated with the placement of concrete and erection of structural steel. Power facilities represent some of today's most complex and challenging construction projects.

### TOWNSEND AND BOTTUM ENGINEERING COMPANY

I hope this will give you a general idea of our interests and capabilities. If you have any questions, please don't hesitate to call.

Sincerely,

Curtis R. Allen

Executive Vice President

cc: C. E. Bottum Jr.

TOWNSEND AND BOTTUM, INC.
ANN ARBOR, MICHIGAN

### TOWNSEND AND BOTTUM, INC., CONSTRUCTORS

Townsend and Bottum, Inc. has a fifty year history of successful general construction experience in heavy industry with emphasis upon power plants and gas utility work. The qualifications of the Company range from production equipment installation through complete project responsibility with design services subcontracted to a professional engineering firm. Townsend and Bottum, Inc. normally constructs about 70 percent of a project with its own forces, subcontracting such specialties as electrical work and insulation.

Townsend and Bottum, Inc. is number 74 in ENR's list of the largest U. S. Construction Contractors in 1971 and was listed number 41 in ENR's list of Design-Constructors in ENR's list of 1970.

Townsend and Bottum, Inc. maintains national agreements with the major building trades unions and is active in developing labor relations climates that will minimize the impact of labor disputes on construction projects.

The following is a list of recent projects Townsend and Bottum, Inc. has under contract or completed:

- ▲ Consumers Power Company D. E. Karn Power Plant, Units 3 and 4, Bay City, Michigan. \$200,000,000 constructed value. Total project responsibility including design, procurement, construction. Engineering subcontracted to Commonwealth Associates, Inc. 70 percent of construction with own forces.
- ♠ Ohio Edison Company Bruce Mansfield Power Plant, Units 1 and 2, Shippingport, Pa. \$400,000,000 constructed value. General Contractorship. 70 percent of construction with own forces.
- ▲ Detroit Edison Company Monroe Power Plant Units 1-4, Monroe, Michigan. \$580,000,000 constructed value. General Contractorship. 50 percent of construction with own forces.

- ▲ Detroit Edison Company Enrico Fermi Atomic Power Plant Unit 2, Newport, Michigan. \$480,000,000 constructed value. Structural Contractor. 35 percent of plant with own forces.
- ▲ Detroit Edison Company Trenton Channel Power Plant Unit No. 9 and St. Clair Power Plant Unit No. 7, Detroit area, Michigan. \$150,000,000 constructed value. General Contractorship. 50 percent of construction with own forces.
- ▲ Columbia-Southern Chemical Corp. Barium Plant, Natrium, West Virginia. \$150,000 contract value. Equipment Installation contract.
- ▲ Duquesne Light Company Shippingport Nuclear Plant, Shippingport, Pa. \$460,000 contract value. Equipment installation contract.
- ▲ Consumers Power Company White Pigeon Gas Compressor Station Units I and II, White Pigeon, Michigan. \$922,000 constructed value. General Contractorship. Constructed complete stations.
- ▲ Ohio Edison Company W. H. Sammis Power Plant, Units 5, 6 and 7, Stratton, Ohio. \$190,000,000 constructed value. General Contractorship. 60 percent of construction with own forces.

Forty or more other projects with responsibility varying from equipment erection through total job including design.

Townsend and Bottum, Inc. employs approximately 130 permanent (salaried) employees. Of these, 45 are college graduates with the majority in the engineering disciplines. In this professional staff are highly qualified construction managers, superintendents, construction engineers and administrative personnel. The Company has experts in labor relations, construction methods, construction equipment, safety cost control and scheduling. Construction craft employment has ranged up to 3,000 in recent times.

The Company owns its office and shop facilities in Ann Arbor and a large fleet of construction equipment.

The Company has on its premises an IBM 360/30 computer with ancillary equipment to process CPM schedules and cost control reports and to handle administrative data. The Company has been active in developing and using modern systems for management of construction projects and has such systems in effect on all its work.

Construction moragement



Denner Sondrack Preservation



Form 10-300 (July 1969)

## UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PAPK SERVICE

### NATIONAL REGISTER OF HISTORIC PLACES INVENTORY - NOMINATION FORM

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DESCRIBE THE PRESENT AND ORIGINAL (II known) PHYSICAL APPEARANCE

The original section of the second Denver Mint building was constructed during the period from 1897 to 1904, in the style of the Second Renaissance Revival. Exterior ground story walls are faced with rusticated Colorado granite. Second story walls are faced with ashlar granite, providing a subtle contrast in exterior wall textures. A granite entablature marks the division between the ground and second stories.

Exterior style elements reaffirm the symmetry of the rectangular plan. High, rectangular windows, framed in marble and surmounted by marble lunettes, open at even intervals from three ground story facades. Originally, the uniform placement and size of windows was disurpted on the rear facade by two pairs of narrow rectangular windows, headed by stepped voussoirs. Later, all such architectural features on the rear facade were obliterated with the construction of a modern addition, which adjoins the original section. The marble lunettes above all ground story openings on the front facade, above two windows on the east facade and above three windows on the west facade are ornately carved in an eagle motif. Each window is accented by rusticated granite voussoirs and marble molding.

An alternate window design, of smaller dimensions, is utilized throughout the second story. Each window opening is doubled by a center marble column, which forms two minor rounded arches within the opening. The solid marble panel above each pair of double arches is decorated by a single marble disc, a motif originally duplicated on the rear facade, above each pair of narrow rectangular windows. Radiating ashlar granite voussoirs form arches above each window opening.

The second story rises to a massive granite cornice, composed of brackets and a decorated frieze. The low, truncated hip roof above is covered in red tile and barely visible from the street.

Wrought iron lamps flank the main entrance on the front facade. Smaller, less ornate lamps were added after the original construction between window arches on the ground story. Additional wrought iron features include the protective grilles at the main entrance, and at all basement and ground story windows. A wrought iron fence was attached to the low, granite retaining wall at a later date, enclosing the Mint property.

The two story Mint building houses, in addition, two basement levels, a mezzanine and a full attic.

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STATEMENT OF SIGNIFICANCE

In February, 1861, Congress approved an act to create the Territory of Colorado. One year later, on April 21, 1862, an act was approved to establish a branch Mint at Denver, in the Territory of Colorado, exclusively for the coinage of gold. Early in 1863, the Secretary of the Treasury was authorized to purchase a private mint building, located at Sixteenth and Market Streets, to house the new branch Mint. Title to the building was obtained from the owners, Clark, Gruber & Company, in April, but due to delays in the delivery of equipment, the Mint was not opened until September, 1863.

Operations at the Denver branch Mint did not conform to the provisions established by Congress. Bullion was melted, refined, assayed, stamped and returned to depositors until 1869, when operations were further restricted to include only melting, assaying and return to depositors. Although bills were repeatedly introduced in Congress, it was not until 1895 that an act was approved to establish a United States Mint at Denver for the coinage of gold and silver. In March, 1895, the Secretary of the Treasury was authorized to contract for the construction of a new building designed to meet the special requirements of a government coinage Mint. On April 22, 1896, a site was purchased at the corner of Colfax Avenue and Delaware Street.

Construction of the new building began in 1897 and continued intermittently, under the supervision of James Knox Taylor, until 1904, when it was turned over to the Federal government. The new building was occupied in 1904 by a nucleus of assay workers from the branch Mint, but coinage operations did not actually commence until February, 1906. Experts from Philadelphia, New Orleans, Washington and San Francisco had been detailed at Denver for months prior to this date arranging the new equipment which, according to the Director of the Mint, was believed to be, "of the most approved designs for all the operations of coinage." Although designed specifically to house an industrial operation, however, great care was devoted to decorative elements. In terms of architectural design, the new Mint building was constructed within the turn-of-the-century tradition of architectural elegance.

Farm 10 300a (Dec. 1968) UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE

# NATIONAL REGISTER OF HISTORIC PLACES INVENTORY - NOMINATION FORM

(Continuation Sheet)

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(Number all entries)

### 8. Significance

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In 1934, international tension necessitated the movement of gold bullion from San Francisco inland, to Denver for safety. The following year, and again in 1944, additions were built on the original structure (indicated on attached drawing) to accommodate growth and increased storage requirements.

As one of two United States coinage Mints in operation at this date, the Denver Mint can easily be defined in terms of national significance. Within the context of local history, however, the Mint has played an equally significant role, symbolizing continuity in the development of Denver from a frontier mining center to a major metropolitan area. Strong emotional ties of pride and shared history have developed over the past one hundred years, binding the Mint closely, as an emotional landmark, to the City of Denver.

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MAJON DIBLIOGRAFINGAL REFERENCES	
Arps, Louisa A. DENVER IN SLICE ILLUSTRATED HISTORY OF THE UNITE Evans. Philadelphia: George Hobart, E. L., comp. "Glitters Miller, Fern V. "A Summary of The United States Mint in Denver	D STATES MINT. Ed. by George G G. Evans, 1893. of Gold." n.d. he History and Operations of
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I. FORM PREPARED BY	
NAME AND TITLE:	
Susan A. Nieminen, Assistant to	o the Director
ORGANIZATION	DATE
State Historical Society of Co	lorado   16 October 71
STREET AND NUMBER:	
200 Fourteenth Avenue	STATE CODE
Cit on tom.	Colorado 08
Denver	NATIONAL REGISTER VERIFICATION
2. STATE LIAISON OFFICER CERTIFICATION	
As the designated State Linison Officer for the Na-	I hereby certify that this property is included in the
tional Historic Preservation Act of 1966 (Public Law	National Register.
89-665). I hereby nominate this property for inclusion in the National Register and certify that it has been	
evaluated according to the criteria and procedures set	Fruit he Consulting
forth by the National Park Service. The recommended	- Court (Courted
level of significance of this nomination is:	Chief, Office of Archeology and Historic Preservation
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Stephen H. Hart	Arrest. J.
Tale Colorado State Liaison Officer	Mlanfluntigt,
	Keeper of the National Register

DEC 1 4 1971

Form 10-301 (Dec. 1968) UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE

# NATIONAL REGISTER OF HISTORIC PLACES PROPERTY MAP FORM

(Type all entries - attach to or enclose with map)

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MAY 5 1976

OFFICE OF SUPERINTENDENT: U. S. MINT AT DENVER

Mr. Frank H. MacDonald Acting Director of the Mint Office of Director of the Mint Department of the Treasury Washington, D.C. 20220

Dear Mr. MacDonald:

It is the pleasure of the Denver Landmark Preservation Commission to inform you that the Civic Center District, including the Denver Mint, was officially designated as a Landmark District of the City and County of Denver by the Denver City Council on April 19, 1976. The designation becomes effective on April 23, 1976. A copy of the designating ordinance is enclosed.

Also enclosed is a map of the Civic Center District (as amended) and a copy of the Denver Landmark Preservation Ordinance. Please note that the effects of the district designation differ from the effects of the previous designation of the Mint as a landmark structure. If you have any questions regarding the provisions of the Ordinance, please feel free to contact us.

The Commission wishes to express congratulations and appreciation for your cooperation in obtaining this designation. The preservation of important elements of Denver's past is vital for the enrichment of its future.

Sincerely,

David A. Wicks Staff Secretary

Langdon E. Morris, Jr., Chairman Edward D. White, Jr., Vice Chairman Mrs. Karl Arndt Joseph B. Barry Thomas Hornsby Ferril Alan Fisher Mrs. Pierpont Fuller Philip Milstein Fred Mazzulla

Enclosures

DAW/rl

cc: Mrs. Betty Higby

## CITY AND COUNTY OF DENVER STATE OF COLORADO

# Certification

I, F.J. SERAFINI, Clerk and Recorder, Ex-Officio Clerk of the City and County of Denver, do hereby certify that the attached is a true and correct copy of Series. Ordinance No. \_173

property described in Section 1 eof and any building permit bilication or other authority to ct or construct an improvement property described in Section 1 eof shall be subject to architectal design review by the Presertion Commission as provided in hand and affixed the Seal stick of the Revised hand and affixed the Seal stick of the Revised hand and affixed the Seal stick of the citinuity. Compatibility, appriateness and relationship of proposed alteration, construction, or demolition with the tent buildings, the district as a lie, and open spaces within the lie, and open spaces within the rict. In such review, the Comsion shall consider the follow.

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\_day of 29th

A. D. 1976

## F. J. Serafini

Clerk and Recorder, Ex-Officio Clerk of the City and County of Denver

Hazel Steries

# THE DENVER LANDMARK PRESERVATION ORDINANCE

Section 131.12

of the Revised Municipal Code

of the City and County of Denver

Note: The Denver Landmark Preservation Ordinance was enacted in March, 1967 (Ordinance 63, Series of 1967) and amended in March, 1974 (Ordinance 155, Series of 1974). The Ordinance transcribed below is the complete amended ordinance. Amended portions are noted.

#### .12. Preservation Commission.

- .12(1). Short Title. This ordinance may be called "The Landmark Preservation Ordinance." (Ord. 63, Series 1967)
- .12(2). Purpose and Declaration of Policy. It is hereby declared as a matter of public policy that the protection, enhancement, perpetuation and use of structures and districts of historical, architectural or geographic significance, located within the City and County of Denver, is a public necessity, and is required in the interest of the prosperity, civic pride and general welfare of the people.

The purpose of this legislation is to (1) designate, preserve, protect, enhance and perpetuate those structures and districts which reflect outstanding elements of the City's cultural, artistic, social, economic, political, architectural, historic or other heritage; (2) foster civic pride in the beauty and accomplishments of the past; (3) stabilize or improve the aesthetic and economic vitality and values of such structures and districts; (4) protect and enhance the City's attraction to tourists and visitors; (5) promote the use of outstanding historical or architectural structures or districts for the education, stimulation and welfare of the people of the City; (6) promote good urban design including the perpetuation of related private open spaces; and (7) promote and encourage continued private ownership and utilization of such buildings and other structures now so owned and used, to the extent that the objectives listed above can be attained under such a policy.

It is the sense of the Council of the City and County of Denver that the economic, cultural and aesthetic standing of this City cannot be maintained or enhanced by disregarding the historical, architectural and geographic heritage of the City and by ignoring the destruction or defacement of such cultural assets. (Ord. 155, Series 1974)

#### .12(3). Preservation Commission

- .12(3)(a). Creation. There shall be and hereby is created a Preservation Commission, hereinafter called the Commission.
- .12(3)(b). Composition. The Commission shall consist of nine members who shall be residents of the City and County of Denver. In making initial appointments, three such persons shall be appointed for a one-year term; three more members shall be appointed for a two-year term; and the remaining three members shall be appointed for a three-year term. Thereafter, appointments shall be for a three-year term.
- .12(3)(c). Appointments. All appointments shall be made by the Mayor, as follows:
- .12(3)(c)(c-1). Two members shall be appointed from a list of not less than four names submitted by the President of the Colorado Chapter of the American Institute of Architects;
- .12(3)(c)(c-2). Two members shall be appointed from a list of not less than four names submitted by the President of the State Historical Society;
- .12(3)(c)(c-3). Three members shall be appointed from a list of not less than six names submitted by the Chairman of the Denver Planning Board; one of the three members shall be a member of the Planning Board;
  - .12(3)(c)(c-4). Two members shall be appointed without limitation.

In making appointments to the Commission, the Mayor shall give due consideration to maintaining a balance of interests and skills in the composition of the Commission, and to the individual qualifications of the candidates, including their training, experience, knowledge or interest in any one or more of the following fields: architecture-landscape architecture; history of the community; real estate; law; city planning; fine arts; general contracting; education; commerce and industry.

In the event of a vacancy occurring during the term of a Commission member, the Mayor shall make an appointment to fill the unexpired term, such appointment to be made in the same manner as that made to fill the position initially.

In the event that the nominations required to make appointments or to fill vacancies have not been received by the Mayor within 30 days after a written request for the required list has been sent to the nominator, the Mayor is authorized to appoint members of the Commission without nominations. However, he shall give consideration to the qualifications of the appointee as if such appointee were nominated by the designated group.

- .12(3)(d). Officers and By-Laws. The Commission shall elect a Chairman and such other officers than a secretary as it may require. The Commission shall make and adopt by-laws for governing its work and it shall conduct its business in accordance with Roberts' Rules of Order.
- .12(3)(e). Meetings. The Commission shall act only at meetings of which not less than five days' notice has been given; provided, however, that in the event that the Chairman declares an emergency to exist, such Commission may meet upon two days' written notice.
- .12(3)(f). Quorum; Action. No official business of the Commission shall be conducted unless a quorum of not less than five members is present. The concurring vote of at least five members of the Commission is necessary to constitute an act the official act of the Commission.
- .12(3)(g). Compensation. Members of the Commission shall serve without compensation. To the extent authorized by Council, such members may be reimbursed for expenses necessarily incurred incidental to their duties for the Commission.
- .12(3)(h). Rules and Regulations. Pursuant to Chapter 123 of the Revised Municipal Code of the City and County of Denver, As Amended, the Commission may adopt rules and regulations for the administration and enforcement of this ordinance, and not inconsistent herewith. (Ord. 63, Series 1967)
- .12(4). Staff. The staff of the Commission shall consist of a Secretary and such other assistants as may be authorized by Council. The Secretary shall be the custodian of the records of the Commission, shall conduct official correspondence and generally supervise the clerical and technical work of the Commission. The Secretary shall be appointed by the Mayor with the consent of the Commission; provided, however, that nothing herein shall be construed to prevent the Mayor from assigning the duties of the Secretary as a part-time function of a present employee of the municipality. (Ord. 63, Series 1967)
- .12(5). Standards for Designation of Structures and Districts for Preservation. A structure or district may be designated for preservation, if it meets one or more of the following criteria:
- .12(5)(a). Historical Importance. The structure or district (1) has character, interest or value, as part of the development, heritage or cultural characteristics of the City, State or Nation; (2) is the site of a historic event with an effect upon society; (3) is identified with a person or group of persons who had some influence on society; or (4) exemplifies the cultural, political, economic, social or historic heritage of the community;
- .12(5)(b). Architectural Importance. The structure or district (1) portrays the environment of a group of people in an era of history characterized by a distinctive architectural style; (2) embodies those distinguishing char-

acteristics of an architectural-type specimen; (3) is the work of an architect or master builder whose individual work has influenced the development of Denver; or (4) contains elements of architectural design, detail, materials or craftsmanship which represent a significant innovation.

- .12(5)(c). Geographic Importance. The structure or district (1) because of being part of or related to a square, park or other distinctive area, should be developed or preserved according to a plan based on—a historic, cultural or architectural motif; or (2) due to its unique location or singular physical characteristic, represents an established and familiar visual feature of the neighborhood, community or City. (Ord. 63, Series 1967)
- .12(6). Procedure for Designating Structures and Districts for Preservation.
- .12(6)(a). Initiation of Procedure. Whenever in the opinion of the Commission a structure or district meets the criteria of a structure or district for preservation, as defined in Section 131.12(5) hereof, the Commission shall contact the owner or owners of such structure or district, outlining the reasons and effects of designation as a structure or district for preservation, and, if possible, shall secure the owner's written consent to such designation. Following this contact the Commission may proceed by officially adopting a resolution: (1) stating that a preliminary investigation by the Commission indicates that the described property is eligible for designation as a structure or district for preservation; (2) stating either that the Commission is in receipt of the owner's written consent to the designation or why the Commission feels that it should proceed without such consent; (3) scheduling a public hearing by the Commission on the question of designation, hereinafter called a designation hearing, at a specified time, date, and place; and (4) directing that the notice of the hearing be given as described in Section 131.12(6)(b) hereof. If notice of the proposed action to the owners of the structures within a district is given from and after the effective date of this section, the issuance of a building permit shall on designation be subject to the reasonable requirements of the Commission. (Ord. 155, Series 1974)
- .12(6)(b). Notice of Hearing. Notice of the designation hearing shall be given as follows: (Ord. 63, Series 1967)
- .12(6)(b)(b-1). Written notice of the time, date, place and subject of the hearing shall be sent by registered or certified mail not less than 30 days nor more than 40 days prior to the hearing to all property owners of record on the date of the resolution who own or who have any legal or equitable interest in the real property being proposed for designation as a structure or district for preservation. Property owners who have not protested in writing the effects of the designation prior to the time and date of the designation hearing before the Commission or who have not protested at the hearing shall be deemed to have consented thereto, and notice of the effect of the failure to protest shall be included in the notice of the hearing sent by registered or certified mail to the affected property owner. (Ord. 155, Series 1974)
- .12(6)(b)(b-2). Signs indicating the proposed action and the time, date and place of the hearing, shall be posted by the Commission for a period of not less than 15 days immediately preceding the hearing on all property proposed for designation as a structure for preservation and on the boundaries of all areas proposed for designation as a district for preservation,

such signs to be prominently displayed and easily readable from abutting public ways.

- .12(6)(b)(b-3). A legal notice indicating the nature of the hearing, the property involved, and the time, date and place of the scheduled public hearing, shall be published once in the official newspaper of the City and County of Denver not less than ten nor more than 15 days prior to the hearing.
- .12(6) (b) (b-4). Written notice of the proposed designation, including the identification of the property, the basis for commencing the designation procedure, and the time, date and place of the hearing shall be given to the Denver Planning Board, hereinafter called the Board, and to the Director of the Building Department not less than 30 days prior to the hearing.
- .12(6)(c). Review by Planning Board. The board shall review the proposed designation with respect to (1) its relationship to the Comprehensive Plan; (2) the effect of the designation upon the surrounding neighborhood; and (3) such other planning considerations as may be relevant to the proposed designation. The board may recommend approval, rejection or modification of the proposed designation and this recommendation shall contain a statement of the basis therefor. The recommendation shall be delivered to the Commission in written form at or prior to the hearing. If the board fails to act within the specified period, the proposed designation shall be deemed to have been approved by the board.

#### .12(6)(d). Hearing.

- .12(6)(d)(d-1). A quorum of the Commission shall conduct the hearing. If a quorum is not present, the hearing shall be cancelled and the designation procedure terminated. A hearing may be continued only if not less than two hours of testimony has been taken, and if the hearing is continued, the time, date and place of the continuation shall be established and announced to those present when the current session is to be adjourned.
- .12(6)(d)(d-2). Reasonable opportunity shall be provided for all interested parties to express their opinions regarding the proposed designation or designations. However, nothing contained herein shall be construed to prevent the Commission from establishing reasonable rules to govern the proceedings of the hearings, or from establishing reasonable limits on the length of individual presentations.
- .12(6)(d)(d-3). Transcripts of the hearings are not required; however, the Commission's records shall include the name and address of each speaker; the organization or person or persons he represents, if any; whether or not he is an owner or holder of some interest in an affected property, or represents such owner or holder; and a summary of the relevant portions of each statement. Written presentations, including the report of the Board, shall be incorporated into the record of the hearing. (Ord. 63, Series 1967)
- .12(6)(e). Findings and Recommendations of the Commission. The Commission shall act officially on each proposed designation within 45 days after the hearing thereon. The Commission may approve, reject, or modify any proposal, but no proposal may be extended beyond the boundaries of the land described in the original resolution unless the initiation and hearing procedure is repeated for the enlarged boundaries. The Commission shall set forth in its recommendations the findings of fact which constitute the

basis for its decision, and shall include detailed design standards for districts (in such form as it deems appropriate) to aid in its review of building permit applications. If the Commission fails to act within the 45-day period, the designation shall be deemed to have been rejected, and the designation procedure terminated. (Ord. 155, Series 1974)

- .12(6)(f). Transmittal to City Council. Within 15 days after reaching its decision, the Commission shall either (1) transmit to the City Council and to the Director of the Building Department the Commission's recommendation on the designation of a structure or district for preservation, including the description of the property involved, and the findings upon which the recommendation was based; or (2) terminate the designation procedure. If more than one property is involved in the designation procedure, the Commission may approve in part and terminate in part. Each part shall then be treated as a separate action. In no event may any property be added to the area described in the initiation resolution without instituting a new designation procedure.
- .12(6)(g). Action by City Council. Upon receipt of the recommendations transmitted by the Commission, the City Council may, by ordinance, designate property as a structure for preservation or a district for preservation. Due consideration shall be given to the written views of owners of affected property and, in its discretion, the City Council may hold public hearings on any proposed structure for preservation or district for preservation designation. However, if no action is taken within 90 days after transmittal of the recommendation, the designation procedure is terminated.
- .12(6)(h). Recording of Designation. Within 15 days of the effective date (date of final publication) of an Ordinance designating property as a structure for preservation or a district for preservation, the Commission shall notify the Director of the Building Department of the official designation and shall record among the real estate records of the Clerk and Recorder of the City and County of Denver either (1) a certified copy of the Ordinance designating specified property as a structure for preservation or a district for preservation, or (2) a notice stating that specified property has been designated as a structure for preservation or a district for preservation, and citing the Ordinance and the effective date thereof which made the designation effective. The notice also may contain a brief summary of the effects of such designation, as set forth in this Ordinance. Failure to record such Ordinance or notice within the required time shall suspend the effective date of the designation until the recording has been made.
- .12(6)(i). Notification. Within ten days after the recording of the Ordinance or the notice of designation of property as a structure for preservation or a district for preservation, the Secretary of the Commission shall send to the owner of each property so designated, by registered or certified mail, a letter outlining the reasons for such designation and the obligations and restrictions created by such designation. (Ord. 63, Series 1967)
- .12(7). Procedure to Amend Or Rescind Designation of Structures and Districts For Preservation. A structure or district for preservation may be amended or rescinded in the same manner as the original designation was made. (Ord. 63, Series 1967)
- .12(8). Procedure to Authorize Erection, Construction, Reconstruction, Alterations to, or Demolition of Structures Designated for Preservation Or Located In Districts Designated For Preservation.

- .12(8)(a). Review of Building Permit. If an application is made for a building permit (including a demolition permit) for any of the following acts:
- .12(8)(a)(a-1). Alteration of reconstruction of, or addition to, the exterior of any improvement which constitutes all or part of a designated structure for preservation not located in a district for preservation;
- .12(8)(a)(a-2). Demolition of any improvement which constitutes all or part of a designated structure for preservation not located in a district for preservation;
- .12(8)(a)(a-3). Alteration or reconstruction of, or addition to, the exterior of any improvement which constitutes all or part of a structure located in a district for preservation;
- .12(8)(a)(a-4). Demolition of any improvement which constitutes all or part of a structure located in a district for preservation;
- .12(8)(a)(a-5). Construction or erection of or addition to any improvement upon any land in a district for preservation; the building permit shall not be issued, except as provided in Section 131.12(8)(f), or unless accompanied by written approval by the Commission. The Building Department shall within seven days transmit to the Commission a copy of said application for the building permit.
- .12(8)(b). Approval of Acceptable Proposed Work for Designated Structures Outside Districts. (1) Upon the reguest of any affected property owner, the Commission shall review any proposal for altering, constructing, reconstructing, erecting, adding to or demolishing any improvement covered by Section 131.12(8)(a)(a-1) and 131.12(8)(a)(a-2) hereof prior to receiving an application for a building permit. If the Commission finds that the proposed work is of a nature which will not adversely affect or destroy any exterior architectural feature of the improvement and is appropriate or consistent with the spirit and purposes of this Ordinance, it shall so indicate in writing and this written approval shall meet the requirements of Section 131.12(8)(a) hereof. (2) If, upon receipt of a copy of an application for a building permit from the Building Department, the Commission finds that the proposed work is of a nature which will not adversely affect or destroy any exterior architectural feature of the improvement and is appropriate or consistent with the spirit and purposes of this Ordinance, the Commission shall so advise the applicant and the Building Department as soon as applicable. but in no event longer than 15 days after receiving the application for the building permit. The approval shall be in writing. Upon receiving the Commission's report of acceptability, the Building Department shall proceed with the review of the application for a building permit. (3) No substantial change shall be made in an application for the building permit approved by the Commission without resubmittal to the Commission, and approval of such changes in the same manner as the original application. (Ord. 155, Series 1974)
- .12(8)(c). Denial of Permit. If the proposed work is not acceptable as outlined in Section 131.12(8)(b) hereof, the Commission shall deny the application for the building permit and shall so advise the applicant and the Building Department in writing as soon as practicable, but in no event longer than 15 days after receiving the copy of the application for the building permit. If no report is made by the Commission within said 15 days, the application for the building permit shall be processed as if it were ap-

proved, provided that no substantial change is made in said application. (Ord. 63, Series 1967)

- .12(8)(d). Action of Commission On Unacceptable Proposed Work. If the proposed work is not acceptable as outlined in Section 131.12(8)(b) hereof, the Commission, acting with all due diligence, shall explore all means for substantially preserving the structure for preservation which would have been affected by the required permit. These studies shall include contact with the original applicant for the building permit. These investigations may include, by way of example, and not of limitation:
  - .12(8)(d)(d-1). Feasibility of modification of the plans;
- .12(8)(d)(d-2). Feasibility of any alternative private use of the structure or structures which would substantially preserve the original character thereof;
- .12(8)(d)(d-3). Possibility of public acquisition for a public purpose of the structure or structures involved. (Ord. 155, Series 1974)
- .12(8)(e). Issuance of Permit On Other Than Acceptable Proposed Work. If the Commission is unsuccessful in developing either alternative plans or an appropriate public or private use for such structure or structures which are acceptable to the owner, it shall so notify the Building Department, in writing. If within 90 days from the date of receiving the original copy of the application for the building permit, the Commission does not submit such statement to the Building Department, the Building Department shall proceed as if such statement had been filed. Upon receipt of the statement, the Building Department shall notify the original applicant that if he files a new application for a building permit for the same work within 12 months of issuance of said notification by the Building Department, the application for the permit shall be processed in accordance with the usual procedures of the Building Department without further delay imposed by reason of this Ordinance. If a period of more than 12 months elapses before the application for a building permit is refiled, or if the new application differs substantially from the original application, the new application shall be handled as if the initial application had not been made. (Ord. 52, Series 1970)
- .12(8) (f). Remedying of Dangerous Conditions. In any case where the Building Department, the Department of Health and Hospitals or the Fire Department or any other duly authorized officer or agency of the City and County of Denver shall order or direct the construction, reconstruction, alteration, repair or demolition of any improvement to a structure for preservation or in a district for preservation, for the purpose of remedying conditions determined by that department, agency or officer, to be imminently dangerous to life, health or property, nothing contained herein shall be construed as making it a violation of this Ordinance for any person to comply with such order or directive without receipt of a statement from the Commission. Any such department, agency or officer shall give the Commission as early notice as practicable of the proposed or actual issuance of any such order or directive. (Ord. 63, Series 1967)
- .12(8)(g). Approval of Acceptable Proposed Work in Districts. (1) Upon the request of any affected property owner the Commission shall review any proposal for altering, constructing, erecting, adding to or demolishing any improvement covered by Sections 131.12(8)(a)(a-3), 131.12(8)(a)(a-4), and 131.12(8)(a)(a-5) hereof. If the Commission finds that the proposed work

is of a nature which will not adversely affect or destroy any exterior architectural feature of the improvement, is appropriate or compatible with the character of the district for preservation as described in the designating ordinance, and is appropriate or consistent with the spirit and purposes of this ordinance, it shall cause the Secretary of the Commission to endorse the submitted proposal and attached plans with the Commission's approval. (2) If the application is for a permit to demolish (as defined in Section 131.12(8)(a)(a-4)), within 8 days of receipt of said permit application by the Commission Secretary, the Commission shall designate a time, place, and date for a public hearing. The public hearing date shall be no longer than 30 days from the date of receipt of the permit application by the Commission Secretary. If the permit application is for an improvement other than demolition (as defined in Sections 131.12(8)(a)(a-3) and 131.12(8)(a)(a-5)), the Commission shall, within 8 days of receipt of the permit application:

- (a Issue a certificate of approval, if the Commission finds that the proposed work is appropriate or compatible with the character of the district for preservation as described in the designating ordinance and is appropriate or consistent with the spirit and purposes of this ordinance; or
- (b) Designate a time, date, and place for a public hearing to be held no longer than 30 days from the date of receipt of the permit application by the Commission Secretary.
- .12(8)(g)(g-1). Review of building permit applications for proposed work, as set forth in Sections 131.12(8)(a)(a-3) and 131.12(8)(a)(a-4) and 131.12(8)(a)(a-5), in districts for preservation shall not be subject to the provisions of Sections 131.12(8)(b) or 131.12(8)(c) or 131.12(8)(d) or 131.12(8)(e).
- .12(8)(h). Public Hearings of the Commission on Proposed Work in Districts. Public hearings of the Commission are to be conducted by the Commission itself or by such members or member its designates; provided, however, that if such public hearing is not conducted by the entire Commission the person or persons so conducting it shall transmit a written report thereupon and forthwith to all Commission members. The Commission or its designated member or members conducting the hearing may adopt such rules or limits as may be necessary to govern the hearing within the proper spirit and purposes of this ordinance.
- .12(8)(h)(h-1). Notification of public hearings of the Commission. Written notice of the public hearing shall be sent to the owner or owners of the property, and to the building permit applicant (if different from the owner or owners), by registered or certified mail giving the time, date, place, and subject of the public hearing, not less than 15 days prior to the hearing. Signs indicating the proposed action and the time, date and place of the hearing shall be posted by the Commission on the property being considered not less than 15 days prior to the hearing. Such signs shall be prominently displayed and easily readable from abutting public ways.
- .12(8)(h)(h-2). Within 10 days after the public hearing, the Commission shall make a determination to approve or deny the application for the permit. The findings of the Commission shall be based on consideration of specified design standards, presented plans, public testimony, and related findings of fact. Notification of the Commission's determination shall be made in writing to the applicant and such persons as requested notification at the public

hearing. Notification shall also be sent to the Building Department within 5 days after the determination.

- .12(8)(h)(h-3). Criteria for Determining Appropriateness of Proposed Work. In determining the appropriateness of work as proposed in an application for a building permit, the Commission shall consider the following:
- (a) All plans, drawings, and photographs as may be submitted by the applicant;
- (b) Information presented at a public hearing held concerning the proposed work;
  - (c) The purpose of this ordinance (Section 131.12(2));
- (d) The criteria used in the original designation of the district in which the property under consideration is situated;
- (e) The historical and architectural style, the general design, arrangement, texture, materials, and color of the building or structure in question or its appurtenant fixtures; the relationship of such features to similar features of the other buildings within the district and the position of the building, structure, park, or open space in relation to public rights of way and to other buildings and structures in the district;
- (f) The effects of the proposed work upon the protection, enhancement, perpetuation and use of the district which cause it to possess a special character or special historical or aesthetic interest or value;
- (g) Whether denial of the permit will involve substantial hardship to the applicant, and whether issuance of the permit would act to the substantial detriment of the public welfare and would be contrary to the intent and purposes of this ordinance. (Ord. 155, Series 1974)

## .12(9). Violations and Remedies.

.12(9)(a). Violations. Wherever, by the provisions of this Ordinance, the performance of any act is required or the commission of any act is prohibited, a failure to comply with the Ordinance shall constitute a violation of this Ordinance. Every day on which a violation exists shall constitute a separate violation and a separate offense.

## .12(9)(b). Remedies.

- .12(9)(b)(b-1). Any person, firm or corporation violating any provision of this Ordinance shall be subject to the penalties provided by Ordinance or by the Charter of the City and County of Denver;
- .12(9)(b)(b-2). In case any building or structure is erected, constructed, externally reconstructed, externally altered, added to or demolished in violation of this Ordinance, the municipality or any proper person may institute an appropriate action or proceedings to prevent such an unlawful erection, construction, reconstruction, exterior alteration, addition or demolition.
- .12(9) (b) (b-3). The imposition of any penalty hereunder shall not preclude a municipality or any proper person from instituting any proper action or proceeding to require compliance with the provisions of this Ordinance and with administrative orders and determinations made hereunder. (Ord. 63, Series 1967)

### 131 REVISED MUNICIPAL CODE CO THE CITY AND COUNTY OF DENVER

- .12(9)(c). Appeals from the Commission. Any person interested in or aggrieved by a decision or action of the Commission may obtain judicial review in accordance with the Colorado Rules of Civil Procedure. Such action to obtain review must be brought no later than thirty days after the action or decision from which review is sought. (Ord. 155, Series 1974)
- .12(10). Extension of Time Limits. Any time limits set forth in this Ordinance may be extended by mutual consent of the Commission and the applicant.
  - .12(11). Definitions.
- .12(11)(d). Alteration: Any act or process which changes one or more of the exterior architectural features of a designated structure for preservation or district for preservation.
- .12(11)(h). District: Any structure or improvement and its surrounding environs or a group of structures or improvements or both, and their surrounding environs.
- .12(11)(1). Exterior Architectural Feature: The architectural style, design, general arrangement, and components of all the outer surfaces of a structure or improvement, including but not limited to the color, texture, materials, type and style of all windows, doors, lights, signs and other fixtures appurtenant to said structure or improvement.
- .12(11)(p). Improvement: Any building, structure, place, work of art or other object constituting a physical betterment of real property or any part of such betterment.
- .12(11)(t). Structure. Anything which is constructed or erected and the use of which requires more or less permanent location on the ground or attachment to something having permanent location on the ground, not, however, including wheels; an edifice or a building of any kind. (Ord. 63, Series 1967)

Denner Londonach Preservation



Construction intaterial





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DMJM REVIEW

SPRING, 1975

### **DMJM REVIEW**

is a semiannual publication of



Daniel, Mann, Johnson & Mendenhall

PLANNING · ARCHITECTURE · ENGINEERING SYSTEMS · ECONOMICS

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COVER PICTURE: The gleaming, newly opened \$26,000,000 St. Vincent Medical Center in Los Angeles, California, is the successor to the early pueblo's first health care facility, which was established by the Daughters of Charity in 1856. The new hospital is the Sisters' fifth Los Angeles location.

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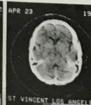


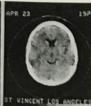


















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#### 1

The operating room suites were designed for highly specialized surgery procedures, such as the craniectomy pictured in progress. The suites are unusually spacious and technically equipped.

#### 2

The radiographic room and its accompanying control room, shown in the two photographs, are typical of the hospital's sophisticated, diagnostic, electronic equipment.

#### 3

Photographing the brain with an EMI machine. Three-dimensional, cross sections, or horizontal "slices" of the brain and the cranium can now be done with this advanced diagnostic equipment, consisting of a scanner, control unit, computer and viewer. St. Vincent is among the first to install this equipment. Pictured above the scanner are its product—actual photographs of a living brain.

#### 4

West side of hospital showing twin tower design and garden patio area, now being landscaped.

#### 5

Sister Andrea, D.C., President of the Board of Trustees stands alongside the large, colored, lobby wall mural, created by Igor de Kansky and donated by the Patrick J. Frawley family.

#### The New St. Vincent Medical Center

by Robert H. Hartman, AIA Associate Vice President Director, Medical Facilities

Dedication ceremonies in March of this year at the St. Vincent Medical Center in Los Angeles brought to a climax a nine-year program to update and replace one of Los Angeles' oldest and most respected hospitals.

Since 1966, DMJM has been the architectural and engineering member of the planning team that designed the modifications to the Doheny and DePaul Pavilions, designed a new 518-car garage, engineered adjacent street and tunnel improvements, and designed the new 314-bed, 353,000-square-foot, twin eightstory hospital facility.

Working with Sister Andrea, President of the Board of Directors; Austin S. Hall, Executive Director; heads of various departments; and Medical Planning Associates, Inc., Hospital Consultants; DMJM began by converting the then existing delivery suite of the Doheny Pavilion into ophthalmologic, otologic and neurosurgery facilities. At the time of their completion these were the first such facilities on the West Coast.

Construction of the new parking garage on Miramar Street was completed in 1971. Concurrently, construction began on the new nursing tower to replace the older structure which had been built in the mid-Twenties. Now, in 1975, as the move of patients, records and supplies is completed from the old structure to the new, the old stone and brick building

will be demolished, opening the new face of St. Vincent's to the major intersections of Third Street and Alvarado.

The Master Plan developed by DMJM includes a future medical office building and additional parking structure.

Begun in Los Angeles by the Daughters of Charity of St. Vincent de Paul (D.C.) in 1856, St. Vincent's has grown into a major cardiovascular center with special emphasis on programs for heart catherization and open-heart surgery. The new facility also provides a great expanded capability in out-patient renal dialysis.

The hospital offers all single-occupancy rooms in the typical patient care units (floors 5, 6, 7 and 8). The 4th floor provides special facilities to accommodate cardiac surgery intensive care, coronary care, medical intensive care, and surgical intensive care. Because of the concentration of highly sophisticated equipment and specially trained nursing personnel on this floor, postsurgical patients are brought directly from surgery via a special direct elevator for initial postanesthetic recovery and concentrated care.

The new St. Vincent Medical Center now provides a total of 512 beds ranging from the above mentioned specialty care beds to the skilled nursing facility in the DePaul Pavilion.

DMJM is proud to have played such a vital role in bringing this significant landmark in Los Angeles health care delivery to reality. We wish the sisters well as they continue into their second century of dedicated service to mankind.





#### **TLC for Hospital Environments**

The Interior Design of Mercy Health Center, Oklahoma City

by Mary Louise Schum, ASID

Mercy Health Center, a \$25.5-million complex in Oklahoma City, Oklahoma, demonstrates dramatically that a large hospital can be beautiful and endowed with a warm, pleasing, tender loving care (TLC) environment. To counteract the technological forces of a modern hospital that may tend to create a stressful environment, the interior designers, Associated Design, Planning & Art, Inc., strove to incorporate elements that would create an atmosphere of comfort and enjoyable distraction. The project also had to be completed within an economical budget. These goals were achieved in three ways:

A total-environment concept. Identification and comfort were partly accomplished through harmony of exterior and interior design; harmony of color, pattern, texture, furnishings, and art forms from exterior to interior, from area to area, and within each area. Patterns, textures, and colors are stronger in public areas, such as lobby and waiting rooms; more subdued and restful in patient rooms, corridors, and recovery rooms. Contemporary furnishings and patterns reflect the contemporary architecture.

A cultural concept. The designers strove to reflect the community and cultural heritage of Oklahoma. Overall color scheme of deep brown and rust tones echoes the Oklahoma landscape and the American Indian heritage. Materials used for furnishings and art forms, such as natural oak, sandy-finished concrete, bronze, plexiglas, ceramic tiles with matte glazes, are all consistent with the site and Oklahoma culture.

Art center concept. The most unusual design feature of the Center is its concept as an art center. All works of art inside and outside of the Center were made possible through donations by members of the community. A series of major art works by Edgar Tafur, ADPA environmental designer, artist and lighting consultant, dominates the lobby, chapel, elevator foyers, and outdoor plaza.

The artist has created two kinds of dynamic, intellectual and spiritual art which are displayed throughout the hos-

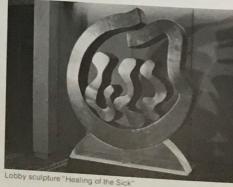
pital's public areas. The intellectual art is illustrated by "The Progress of Medicine," a 44-foot porcelain-on-steel enamel mural, "Healing the Sick," a 71/2foot abstract bronze sculpture made up of circular forms, and precast concrete lobby murals with geometric forms.

Spiritual, humanistic art has been designed to attract the mind to meditation and inspire the soul. These are seen in a 24-foot-high Corten steel cross located in the outdoor plaza; a series of five ceramic tile murals in the outdoor plaza; a series of five ceramic tile murals in the upper level lobbies, each depicting an event in the life of Christ; and precast concrete murals with religious motifs, in the hospital chapel.

The Mercy Health Center thus typifies the continuum of man, of body and spirit, and man's need for both a physical and spiritual physician to cure all the ills to which humankind is heir.

ADPA is a subsidiary of Daniel, Mann, Johnson, & Mendenhall, specializing in commercial, industrial and institutional space planning and interior design. The firm has offices in Los Angeles, California, and Hamilton, Ohio. Mrs. Mary Louise Schum, ASID, was project manager for the design of the Mercy Health Center, which has received the 1975 Burlington House Award for Institutional Interiors and a 1975 Hexter Award. Edgar A. Tafur was responsible for concept, design and the fabrication and installation of the Center's art work.

Current hospital interior design projects include: St. Claire's Hospital in Schenectady, New York; renovation of the Georgetown University Hospital and an addition to its Acute Care Center, Washington, D.C.; and a major addition to the Mercy Hospital, Chicago, Illinois.



The lobby is a veritable contemporary art gallery with concrete wall murals, bronze sculpture, 44-foot long mural, and strongly patterned carpeting in brown, rust, red and blue.

Patient rooms are private, restrained in color and pattern Simple casement draperies, vinyl grass-cloth wallcovering, light oak furniture and muted design of the carpet are quiet and offset by livelier design of spread and chair

The spaciousness of the 260-seat cafetorium is enhanced by cloud-like pattern of the carpeting and undulating stripes of wall covering, heightened by the daylight effect of the ceiling skylights.

The white, yellow, silver, chrome and glass of the gift shop combine to create a totally airy and cheerful atmosphere. "Tulip" chairs in bright yellow on white pedestals, form an interesting focal point

Precast concrete mural with religious symbols forms altar section in the chapel. Gentle contours of plywood seats form pleasing contrast to this wall and the strong geometric pattern of the









#### Stopping The Gold Drain

New DMJM Process Increases Industrial Recovery of Precious Metal

by John F. Beall, Vice President DMJM/Technical Management Services, Inc.

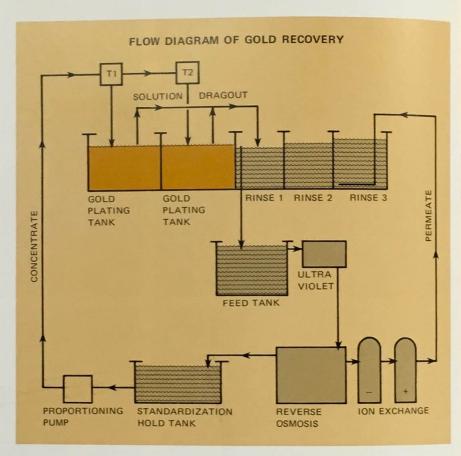
Gold is the ancient material that has made many of our modern, micro-miniature circuits and electronic devices possible, giving our communications systems their reliability and endurance. Wherever electrical current flows, no other material can equal gold and gold alloys for superior hardness, tensile strength, lubricity and corrosion-resistance.

The applications for gold in industry have increased almost as greatly as its price. The actual amount of gold used, however, has decreased from about 6.5 million troy ounces in 1969 to a current usage of about 4.5 million, through concerted efforts in waste control and more efficient utilization. At today's prices, reducing gold consumption and waste is absolutely essential for many industries to remain competitive. DMJM engineers have been working on this problem as well as the conservation and recycling of other valuable materials.

During an investigation and evaluation of various processes for gold recovery recently in connection with the design of an electroplating operation, DMJM developed a new method that can be called a breakthrough in gold recovery technology. Through the use of a proprietary high-pressure permeator or membrane, over 99 percent of the gold can be recovered from the rinse water for reuse.

The process is reverse osmosis. Gold-containing rinse waters from the plating process are pumped at high pressure through a series of membranes. The "permeate," or liquid, in passing through the membranes, has chemical impurities, including the gold, removed and is returned to the rinse cycle as purified water. The "concentrate" (about 8 percent of effluent volume) is retained by the membrane, and this solution containing the gold can be returned to the plating tank for reuse, after some adjustment and purification in an intermediary holding station.

The small residue of gold (less than 1 percent of the amount in the rinse) not



retained by the membrane is captured in an auxiliary ion-exchange unit through which the permeate passes on its way back to the rinse cycle.

The current systems and equipment widely used in the plating industry for gold recovery all have major disadvantages in high costs, excessive energy consumption and low gold recovery rates.

Reverse osmosis, on the other hand, requires energy only for the pump. The membrane has a useful life expectancy of about 18 months, and the gold recovery rate exceeds 99 percent. With traditional methods, a recovery rate of 80 percent is considered very high and is seldom achieved.

An example of the costs and savings potentials in a typical gold-plating operation is the following: a plant may have four gold-plating lines, doing 10 loads per hour or 40 loads for the four lines. In barrel-type gold plating, used widely in industry, each barrel drags out of the gold-plating tank about a quart of solution, which equals 40 quarts of solution per hour containing one punce of gold

per gallon. This amounts to 10 ounces of gold per hour put into the rinse waste system.

With gold at \$160 per ounce and a normal production schedule, the value of gold wasted annually in a typical operation is: (10 oz/hr) (8 hr/day) (250 annual working days)=\$1,600x8x250=\$3,200,000.

Even the exceptionally high recovery rate of 80 percent means that \$640,000 worth of gold is literally going "down the drain." The DMJM reverse osmosis system can achieve a recovery efficiency of 99 percent or better, resulting in a maximum loss of \$32,000—a significant figure, but considerably less than the best record of conventional systems. And it can be done as a modification to existing production lines.

DMJM/Technical Management Services Inc., a wholly owned subsidiary of Daniel, Mann, Johnson, & Mendenhall, specializes in the design and installation of industrial facilities, process controls, and waste treatments.



#### The on-shore side of off-shore oil

DMJM and the Environment in Santa Barbara, Calif.

by Joseph A. Pantuso, Acting Manager, Planning & Economics Division



Of all the environmental impact statements that DMJM has done, none was more exhaustive nor the center of so much controversy as was that prepared for the County of Santa Barbara, California, in 1974, for a proposed onshore oil processing site in Las Flores Canyon, a bucolic spot 20 miles above the Channel City.

The petitioner for a zoning change for the 80-acre parcel was the Exxon Oil Company. The man in the middle was the Santa Barbara Director of Environmental Quality. Arrayed against the zoning change were powerful foes of offshore drilling—GOO (Get Oil Out); SEA (Seashore Environmental Alliance); and the Sierra Club. To get the facts, DMJM's Los Angeles office was hired to develop an environmental impact statement—a job that took about five months, with another period of equal duration for public hearings and final development.

The opposition to Las Flores development was aimed more at the off-shore drilling platforms that it would support, than at the actual site. The strategy was: if the onshore processing station, separation facilities, tank farm and pumping station could be stopped, it would effectively prohibit oil exploration and drilling in the Santa Barbara Channel.

DMJM's role was not that of a partisan in this community strife, but rather that of a fact-gatherer, an explorer and analyst of all the possible impacts. The vegetation, wild life, hydrology, geologic and seismic hazards, air and water quality—these and more were studied.

The proposed development involved removal of 500,000 cubic yards of dirt

and the replacement of 1500 feet of Las Flores Creek with an underground culvert; this, too, was studied.

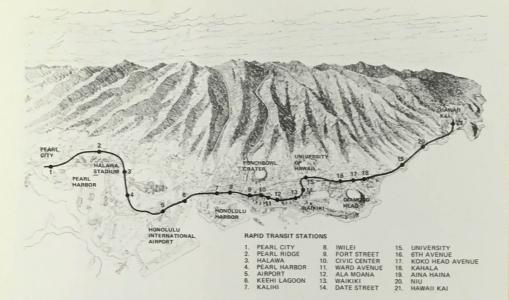
When public hearings opened, DMJM's technical team found themselves somewhat in the position of a defendant in the docket—presumed guilty of wrongdoing—such were the high feelings that oil development excites in Santa Barbara.

The final result was high praise for DMJM, for its professional work, and the County Board of Supervisors' approval of the Exxon zone change—with 75 conditions. The complex was also approved by the Santa Barbara voters at an election on May 27, 1975.

Today, Las Flores is still the home of birds and other wild life; it lies undisturbed, as it has for centuries. It is also one of the most thoroughly studied sylvan glades in the Golden State. When developed, as it ultimately will be, the installation will prove that man and nature can exist together, for the mutual benefit of each.

Recent projects of DMJM's Planning & Economics Division include an environmental impact statement for California's Orange County Airport, the development of terms and conditions for the transfer of federal lands along the Colorado River in Nevada, and a citizens involvement program for the California Department of Transportation on the extension of the Long Beach Freeway.





#### From Pearl City to Hawaii Kai

The New Honolulu Rapid Transit System

by Shu Magota FASCE Associate Vice President

Honolulu embodies many changing and surprising aspects. There are indeed romantic blue lagoons and flaming sunsets, smooth beaches and glamorous hotels. But alongside these there is also accelerated urban growth which, over the past decade, has severely strained Honolulu's capacity to maintain its high quality living environment. This growth has caused a variety of problems, including a critical demand for new transportation services.

The Honolulu metropolitan region can be broadly characterized as having a linear pattern of development, extending along the leeward shore of the Island of Oahu between the Koolau Mountain Range and the sea. Land here is limited, and orderly expansion cannot occur without increased congestion of the street and highway system.

In 1967 a major step towards solving this problem was taken. The Oahu Transportation Study was completed and recommended a long-range transportation plan oriented towards relieving the heavily congested streets and highways. This study, in which DMJM participated, had the foresight to conclude that a fixed guideway rapid transit facility would give balance to the transportation system recommended in the plan.

Since it was clear that an improved mass transportation system could best

serve the mobility needs of Honolulu while protecting the social, ecological and economic environment, the City and County of Honolulu engaged DMJM's Transportation Division to participate in the refinement of their comprehensive transportation plan. A two-phase Preliminary Engineering Evaluation Program, now in progress, was then begun.

The DMJM studies examined a variety of system alternatives, evaluated route locations, studied alternative vehicle types, and engaged in environmental impact and cost-benefit analyses. They concluded that a rubber tired, fixed guideway system, supported by an extensive feeder bus system, would be most suited to the needs of Honolulu, providing a convenient, economic and pleasant travel mode for residents and visitors.

The transit plan recommended that a 23-mile fixed guideway system with 21 stations connect the major activity centers of urban Honolulu. The route includes 1.7 miles of subway through the historic downtown district of Honolulu, 15 miles of aerial alignment located predominantly in public rights-of-way, and 6.3 miles of at-grade alignment within the rights-of-way of existing freeways. The program will be implemented in phases with initial expenditures estimated at \$500 million.

DMJM is also currently working on urban mass transportation programs for New York City, Baltimore, Maryland, Seattle, Washington, and Washington, D.C. Architecture and Prison Bars by Richard G. Conklin, AIA Associate Vice President



The current national controversy over whether or not to continue building prisons coincides with the public's growing awareness of the correctional environment. The one event most responsible for public education on existing prison conditions was the Attica revolt of 1971. The loss of lives in that incident was tragic. That there are so many prisons all across America that duplicate Attica's physical environment must be considered just as tragic, for they generate the same potential for riots as Attica.

The reason there are so many prisons like Attica is understandable: it is one of a breed of punishment-oriented, labyrinthian bastilles that were built in a relatively short period during the 19th century. Most of them reflect the architectural advice of an 1862 encyclopedia: "The exterior of a prison should be formed in the heavy and sombre style which most forcibly impresses the spectator with gloom and terror." This advice was generously applied to the interiors of prisons as well as to the exteriors.

A recent DMJM nationwide study of oriminal justice facilities gave the author the opportunity to inspect all of California's major prisons, the oldest of which is Folsom, occupied in 1880. Folsom is the prime example of a 16th century Spanish admonition that prisons "be constructed of rough stones to appear fearsome," being the product of the stone quarry in which it sits. Surprisingly, the other prisons in California, some built a half-century later, offer little or no improvement in environment, security, amenities, convenience, or flexibility than the oldest prison in the state.

If the impetus for prison reform was actually emerging during the years in which these facilities were constructed, as is generally believed, it was certainly not evidenced in the buildings themselves. The frustration that is currently being expressed by prison administrators, penologists, sociologists, planners, and prisoners is embodied in these rigid facilities. They cannot possibly respond to new enlightened attitudes and innovative programs that are intended to rehabilitate, rather than punish, offenders. The rationale for not building more of them is quite obvious.

On the other hand, the rationale for designing and constructing a new generation of correctional facilities is just as obvious. As America's population continues to enlarge, as crime rates continue to escalate, and as an enraged public demands prompt treatment of offenders, the prison population will necessarily increase. Logic does not support the concept of suspending all prison construction and turning the overflow of offenders back into society without correctional treatment. The need for prisons is unlikely to change, simply because opportunities for crime remain unchanged, as does human nature itself. What will have to change is the type of treatment an offender receives and the type of facility in which it is administered. Today's emphasis in prison design is on smaller institutions that treat inmates with similar behavioral characteristics. New correctional facilities are intentionally noninstitutional in appearance and are usually located near residential communities to lessen the degree of separation of inmates from their families and home environments and, consequently, to lessen the extent of each offender's reentry adjustments.

Concurrent with public interest in prison conditions, there is a concerted effort by private firms, like DMJM, who are concerned with correctional philosophy and facilities, to research and design new physical environments that will respond to today's correctional needs. It is hoped that this new generation of prisons will, unlike the Attica species, also accommodate the demands that future programs will impose on them, for the benefit of citizens on both sides of prison bars.

Mr. Conklin is a member of the national AIA Committee on Architecture for Justice, is serving his third year on the California AIA Corrections Committee, and is a member of the American Correctional Association.









Wally Findlay Art Gallery

New Life for Old Buildings

Like an ancient performer whose audience and popularity have faded-vet with the passage of time can be rediscovered as original, new talent - so it is. too, with many of the older buildings in our inner cities. They can come back, with a new look, and often, a completely new act.

Renovation, remodeling and recycling of an older building needs a special type of property owner-as well as architect-engineer. It requires imagination, a sensitivity to the character of the building's original design and an appreciation for the era in which it was built. Fortunately for the vitality of our cities, there are venturesome owners who are able to orchestrate these new and dramatic renovations. DMJM has contributed to notable successes in this field, illustrated by several projects in Los Angeles, California, and Portland. Oregon, which are portrayed in this article.

Recycling an older building can be both cosmetic and organic. It can be brought up to code with new electrical and mechanical systems, with improved lighting, ventilation and acoustical control, as well as a comfortable, new interior. Often the entire use of a building is changed. The competitive cost advantages of "old" versus "new" construction can be the compelling reason for recycling an older building.

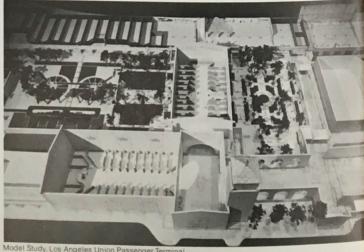
There is also dramatic evidence of a sizable group of tenants who prefer

the stately quality of the older buildings, with their marble, woods, and decorative accouterments, and the downtown location.

DMJM's team approach to recycling the older building has been very successful, as can be seen from the illustrated proiects. The work involves the company's specialists in design, marketing and feasibility studies, and electrical, mechanical and structural engineering. Along with the work of revitalizing the older building, there is also the satisfaction of seeing how it can give new life to the neighborhood and improve the entire downtown aesthetic. By Robert W. Kite, AIA, Vice President, and Robert K. Cloud, AIA, Director of Architecture, DMJM/ Hilton, Portland, Oregon.







Model Study, Los Angeles Union Passenger Terr

### Bishop's House

Once the office of the Roman Catholic Rishop of Portland, the stately residence was sold and endured a blushing history that included such irreverent uses as a speakeasy, tong headquarters, and gambling den. Now, restored to honest rade its remodeled three floors provide modern office space to a variety of commercial tenants

#### Wally Findlay Art Gallery

Localed on Beverly Hills' elegant Rodeo Drive, the remodeled commercial space was honored with an award from the Beverly Hills Architectural Commission. The vaulted, two-story-high facade of polished black granite, gives 42 feet of display space on a 29-foot frontage.

#### Los Angeles Passenger Terminal

DMJM recently completed economic, architectural and engineering studies for the highest and best use of the station grounds. Recommended was its reconversion into a specialty shopping and dining area. The station would still continue to be used as a passenger depot.

#### Morgan's Alley

A deteriorating 62-year-old building in downtown Portland was remodeled into new offices, with the ground floor becoming "Morgan's Alley"-a shopping and dining area. Now expanded to 26 shops, it has effected a renaissance for the entire neighborhood. It received a special citation from the Portland Chapter of the American Institute of Architects.

#### The Mohawk Gallery

An empty drygoods store and meat market provided a site for the creation of new commercial space that is now one of the most attractive office buildings in Portland, Oregon. The store space was renovated, and the meat market was demolished for a new structure. The old and new construction were unified with an attractive used-brick facade. A parking garage for 75 cars was created in

### Los Angeles Jewelry Mart

A most outstanding success story of building renovation is the Los Angeles lewelry Mart, a nine-story building with 300 tenants who represent every phase of the jewelry trade. The multi-milliondollar renovation program replaced verything in the building but its original structure The open inner court has a eceted mirrored skylight at the second evel and colored, abstract patterns on he four walls that rise eight stories





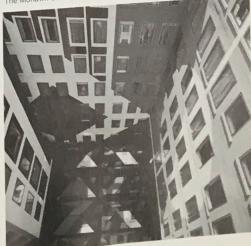












Los Angeles Jewelry Mart



S. Kenneth Johnson, II, FAIA 1912-1974

The death of S. Kenneth Johnson on November 1, 1974, was the second time in as many years that a DMJM co-founder has passed away.

To commemorate his life and to further the interests to which he dedicated so much of his enthusiasm and energy, DMJM has established the S. Kenneth Johnson Memorial Fund with the University of Southern California, for the graduate school training of architectural students. The fund may be augmented with additional donations from friends and colleagues, who may wish to join DMJM in commemorating an outstanding gentleman and advancing the profession of architecture.

Contributions may be sent to the Dean, School of Architecture & Fine Arts, University of Southern California, University Park, Los Angeles, California 90007.

#### New Chairman, President Named

A program for the succession of DMJM's management to a second generation of personnel had been developed under the chairmanship of S. Kenneth Johnson and was made effective after his passing.

Elected Chairman of the Board and Chief Executive Officer was Irvan F. Mendenhall, FASCE, who had served as DMJM President for the preceding 15 years. Elected President and Chief Operating Officer was Albert A. Dorman, FASCE and AIA. Mr. Dorman had advanced through the project management and officer ranks of the company, to manager of corporate development and executive vice president prior to his election.

#### Fermi Accelerator Laboratory, Wins National Engineering Honors

The American Consulting Engineers Council (ACEC) bestowed their prestigious national honor award on the Fermi National Accelerator Laboratory and the DUSAF joint venture that designed and built the 500-billion-electron-volt test facility, which is used for basic research in high energy physics. DMJM was sponsor of the joint venture in Batavia, Illinois, which had previously received awards for outstanding design from the American Society of Civil Engineers (ASCE) and the Consulting Engineers Association of California.



### DMIM DMJM REVIEW

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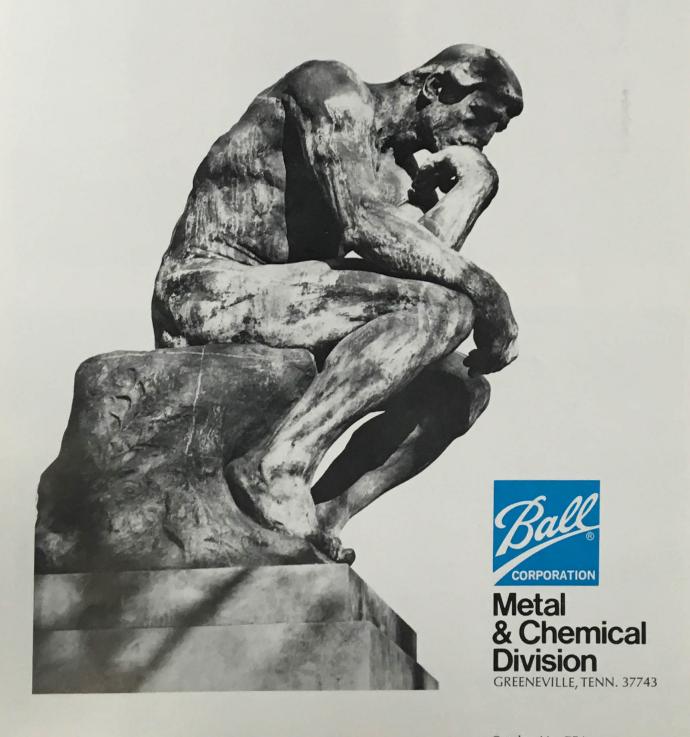
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For enduring beauty...

# **THINK MICROZINC 70**



### MICROZINC 70

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Southeastern Bible College Chapel, Lakeland, Florida 33801. Architect: Setliff-Regnvall, Lakeland, Florida 33801. Roofer: Florida Sheet Metal Inc., Lakeland, Florida 33801. Distributor: Florida Builders Supply, Tampa, Florida 33605.



L. S. Ayres & Company department store, Greenwood, Ind. Architect: James Associates, Indianapolis, Ind. Roofing & Sheet Metals: Henry C. Smither Roofing Co. Indianapolis, Ind.



## **Advantages and Design Considerations**

# Advantages For Architectural Use

Enduring Beauty—Microzinc 70 is a non-rusting zinc-copper-titanium alloy that is preweathered to an attractive, uniform, non-fading, non-reflective gray patina that needs no further protective coating or painting. Preweathered Microzinc 70 is supplied with a natural gray patina which normally would take non-preweathered zinc up to a year to develop. It is, therefore, valued for its distinctive and natural color which can beautifully complement many other building materials, such as wood or masonry. Unlike many other metals, Microzinc 70 does not cause unsightly weathering stains.

Material and Installation Economy-Microzinc 70 used in roofing systems can be supplied in integrated packages of pre-formed parts. This system is designed to eliminate possible installation errors which could be extremely costly in both time and materials. The excellent bending and roll forming properties of Microzinc 70 also add to the possibility of additional savings in the forming of mansards, fasciae, and gravel stops. Many of these forming procedures and techniques which can be used on Microzinc 70 are described in the Architectural Sheet Metal Manual. The fact that no special tools are required in soldering also adds to its attractiveness and installation economy when Microzinc 70 is used in roof installations. See comparative properties and pricing chart on page 11.

Maintenance Economy—Scratches or abrasion marks which may be formed during installation, handling or even over the life of the roof are naturally healed through the formation of a protective zinc carbonate film at the damaged area. It is this dynamic self-healing property of Microzinc 70 which causes it to be maintenance-free even after 20 years of atmospheric exposure. Unlike uncoated aluminum, pre-weathered Microzinc 70 has good life expectancy in many diverse environmental conditions. Some of the expected annual zinc corrosion losses as experienced under a variety of environmental conditions are indicated in the table above:

	Corrosi	on Rate—I	nches Per Ye	ar*		
Grade of Zinc	Palmerton,	New York City	Pittsburgh,	Key West,	Montauk Point, L. I. N.Y.	Hanover N. M.
Rolled high-grade +1.0% Cu and 0.01% Mg.	0.000052	0.00023	0.00015	0.00026	0.00016	0.000014

\*The Corrosion Handbook, edited by Herbert H. Uhlig, Ph.D., John Wiley & Sons, New York, May, 1966.

Weight Economy—Microzine 70 weighs 25% less than copper and 10% less than steel. This reduces dead loads, shipping costs and labor construction costs.

**Compatibility**—Microzinc 70 can be used in direct contact with mortar or concrete without special protection, making it ideal for such applications as thruwall flashing.

# **Design Considerations**

**Expansion and Contraction**—Standard sheet metal practice is used as described in the Architectural Sheet Metal Manual. Cleats allow Microzinc 70 to move as the temperature changes. The rate of expansion is similar to that of aluminum.

**Recommended Bend Radii**—At room temperature Microzinc 70 may be bent on the following radii:

iciozine 70	illay	DC	DCI	it Oil	uic	Tollowing rauli
.010032						1 x thickness
.033040						2 x thickness
.041050						3 x thickness

Contact with Wood and Other Metals—Microzinc 70 must not be applied directly over purlins and must be insulated from acidic woods. It can be used in contact with galvanized steel and aluminum. In combination with other metals, an insulating barrier of asphaltum paint or teflon tape must be used.

**Federal Specifications**—Microzinc 70 conforms to Federal Specifications QQZ100A for zinc alloys and HUD specifications for metal roofing.

### **NEW! MICROZINC 70**

### Batten Seam LOK System™

- ☐ On-site labor greatly reduced
- ☐ Snap-locks in place
- ☐ Preformed—minimizes error
- ☐ Easily soldered if required

Installation-Minimum Roof Pitch of 3" in 12"

Components of the Ball Batten LOK System consist of the roof pan and the preformed "U" channel, eave strip, support spacer, and batten cap.

The pan width (center line of batten to center line of batten) may be formed on site to any width starting with 25-13/16" and working down to whatever size is desired. The most economical installation is accomplished by using standard sheet widths yielding 25-13/16", 21-13/16" or 17-13/16" center to center seams.

Microzinc 70 is applied over solid decking only. Do not apply over purlins. Use roofing felt over the deck. A vapor barrier should be applied over the roofing felt only if the architectural design calls for the use of a vapor barrier.

Secure the "U" channel to the deck with galvanized (hot dipped) or aluminum nails or screws, centering the "U" along the longitudinal line of the batten seam.

Secure the spacer to the deck in the same manner as the "U" channel, centering the spacer between the "U" channels. The width of the spacer should be a minimum of 4" with greater widths used for the wider pans allowing no more than 8" unsupported span beneath the pan across the width of

the pan. The spacer should always support the transverse seam. On runs exceeding 10 feet, there should be 6" left open between spacer ends to facilitate cross air flow.

Position the formed sides of the pans over the "U" channel.

Using the hand "snap lock" tool, punch (dimple) through the pan and channel every 6" securing the pan to the channel and thus creating the lock line

End capping and lap joints must be made before snapping batten cap into place.

Pan ends at transverse seams are treated in the same manner as detailed in the Standard Sheet Metal Practice Manual for forming and cleating.

Preformed ventilated eave strip is required at the eave, and ridge ventilation must be provided. The ridge cap may be of any design as long as it is protective and provides for underside pan ventilation.

Refer to tables on pages 10-11 for limitations and physical properties.

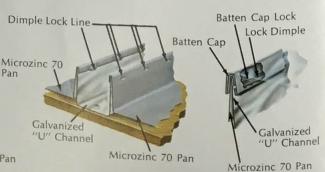
#### SUGGESTED SPECIFICATIONS

Furnish and install Microzinc 70 Batten Seam LOK System where metal roofing, fasciae, flashing and capping are indicated on drawings. The material specification is Microzinc 70 available from Ball Metal & Chemical, Division of Ball Corporation, Greeneville, Tennessee 37743

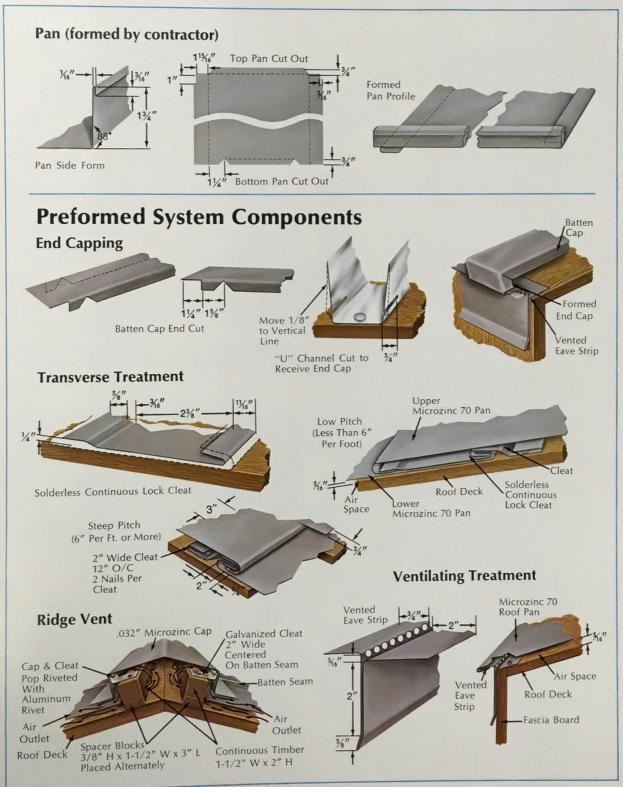
### **Batten System Assembly**



### Channel/Pan Assembly







### **NEW! MICROZINC 70**

### Standing Seam LOK System™

- ☐ On-site labor greatly reduced
- ☐ Snap-locks in place
- ☐ Preformed—minimizes error
- ☐ Easily soldered if required

Installation-Minimum Roof Pitch of 3" in 12"

Components of the Ball Standing Seam LOK System are the roof pan and the preformed "L" seam support strip, eave strip, support spacer and seam cap.

The pan width (center line of seam to center line of seam) may be formed on site to any width starting with 26-1/16" working down to whatever width is desired. The most economical installation is accomplished by using standard sheet widths yielding 26-1/16", 22-1/16" or 18-1/16" center to center seams.

Microzinc 70 is applied over solid decking only. Do not apply over purlins. Use roofing felt over the deck. A vapor barrier should be applied only if the architectural design calls for the use of a vapor barrier.

Secure the "L" seam support strip to the deck with hot dipped galvanized or aluminum nails or screws centering the vertical edge along the longitudinal line of the standing seam.

Secure the support spacer to the deck in the same manner as the "L" seam support strip, centering the spacer between the parallel "L" strips. The minimum width of the support spacer is 4" with greater widths used for wider pans allowing no more than 8" unsupported span across the width

of the pan. The spacer should always support the transverse seam, and 6" should be left open between spacer ends on spans greater than 10 feet to facilitate cross air flow.

Position the formed pan sides over the "L" seam strip. Using the hand "snap lock" tool, punch (dimple) through pan sides and "L" strip alternating sides every 6" securing the pans to the "L" strip and creating the lock lines.

End cuts and laps must be made before snapping the standing seam cap into place.

Pan ends at transverse seams are treated in the same manner as detailed in the Standard Sheet Metal Practice Manual for forming and cleating.

Preformed ventilated eave strip is required at the eave, and ridge ventilation must be provided. The ridge cap may be of any design as long as it is protective and provides for underside pan ventilation.

Refer to tables on pages 10-11 for limitations and physical properties.

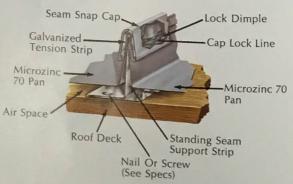
### SUGGESTED SPECIFICATION

Furnish and install Microzinc 70 systems where metal roofing, fasciae, flashing and capping are indicated on drawings. The material specification is Microzinc 70 available from Ball Metal & Chemical, Division of Ball Corporation, Greeneville, Tennessee 37743.

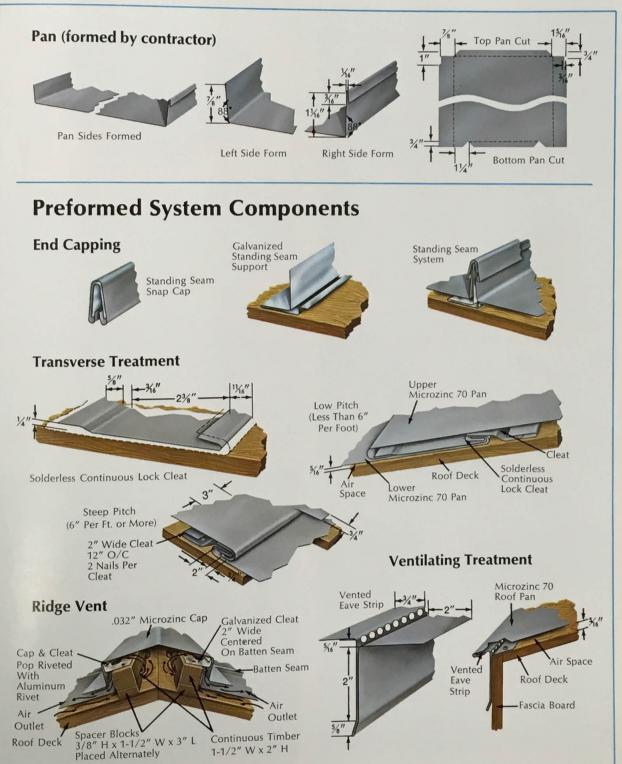
### **Standing Seam System**



### **Seam Assembly**





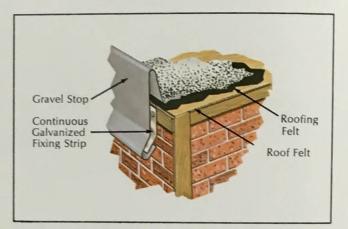


### MICROZINC 70

### Fascia, Gravel Stop, Flashing, Guttering



Hillsborough Community College, Ybor City Campus, Tampa, Florida 33605. Architect: Friedman & McKenna A.I.A., Diaz, Seckinger & Associates, Tampa, Florida 33605. Distributor: Florida Builders Supply, Tampa, Florida 33605.

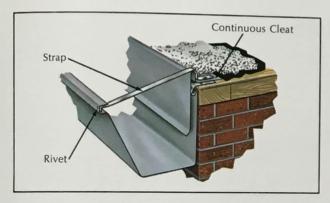


Fascia and Gravel Stop. - Microzinc 70 is an ideal material for fasciae and gravel stops. Expensive maintenance at the roof line is virtually eliminated because Microzinc 70 does not require painting. The attractive gray color will not spall, chip, or crack and, of course, the finish cannot peel. Fasciae and gravel stops are made from Microzinc 70 in lengths not greater than 10 feet. Expansion joints with a minimum 3" lap should be allowed. Cleats are used to secure the gravel stop not more than 8" apart so as to allow this edge freedom for expansion and contraction. Fasciae and gravel stops should be locked with a continuous cleat made from .032 Microzinc 70. Edge strips used to fasten the bottom of a fascia should be secured with galvanized steel nails spaced not more than 4" apart. With any fascia of 6" or more width, use .032 Microzinc 70.



The Long Glass Enlisted Men's Service Club, Panama City, Florida 32401. Architect: Ellis W. Bullock, Jr., Pensacola, Florida 32503. Roofer: American Roofing Company, Montgomery, Alabama.

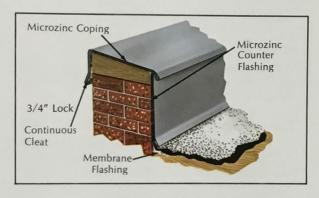




Bracket Hung Rectangular Gutters and Downspouts --

(Not recommended for built-in gutters). Gutter backs should be a minimum of 1/2" higher than fronts. Flashing or drip strip should extend back under roof covering a minimum of 4". Gutters shall have a minimum fall of 1/2" in 30 feet with maximum length in one piece not to exceed 30 feet. Expansion joints are required for long runs allowing 1/4" of expansion for every 10 feet of gutter. Gutters shall be supported by galvanized steel brackets 30" on center maximum spacing, supported from the underside to allow for movement between gutter and roof covering as well as between gutter and support bracket. Microzinc 70 spacers shall be installed in gutters alternately with hangers for additional strength. Microzinc 70 gutters should never be nailed or riveted to supports. Downspouts shall be mounted to allow for thermal expansion with 1" minimum clearance from wall. Joined lengths of downspout should extend a minimum of 13/4" into lower pipe. A 3" sliding socket should be provided for entry into drain pipe. Galvanized bands or strap fasteners should be at 10 foot minimum intervals.

See chart for required thickness, dimensions and acceptable standards.



Cap Flashing. Provide .032" thick Microzinc 70 cap flashings at top edges of base flashings. Form flashing in 8 to 10 foot lengths except where shorter lengths are required. Do not solder or weld joints. Stagger cap flashing joints in relation to base flashing joints. Extend cap flashing into masonry and other walls. Cap flashing should be installed to provide drainage.

**Base Flashing.** Provide Microzinc 70 base flashings where built-up or other type roofs and vertical surfaces abut. Provide loose-locked joints not more than 8 feet from external and internal corners and in straight runs. Allow for expansion and fill joints with sealing compound.

Microzinc 70 Bracket Hung Rectangular Gutter (Typical rainfall intensity of 6" per hour for 5 minutes)

Girth (Inches)	Gutter Dimensions (Inches)	Effective Cross Section (Inches <sup>2</sup> )	Minimum Metal Thickness (Mils)	Maximum Gutter Lengths (Feet)	Maximum Roof Area (Feet²)	Hanger Spacing (Inches
10	2 2.5	4.75	27	30	325	30
13.5	31,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	11	27	30	750	30
16	3.75 4.5	17	27	30	1200	30
20	4.75 5.5	30	32	30	2200	30
23	7.5 5.75 6.5 8.5	44	40	20	3000	30

### **MICROZINC 70**

### **Specifications and Estimating Data**

#### **GENERAL SPECIFICATIONS**

#### Basic use

All types of flashing, fasciae, gravel stops, mansards and roofing where a permanent, maintenance-free product is desired.

#### Limitations

All Microzinc 70 surfaces must drain. Underside ventilation must be provided on roofing and mansard applications per specifications. Must not come in contact with acidic woods or with metals other than aluminum or galvanized material. Not recommended for roofing installations with pitch less than 3" in 12". Provisions must be made for expansion and contraction. See Tables for physical properties. Cannot be applied over purlins. *Solid roof deck required*.

#### Composition

Microzinc 70 is a non-rusting zinc-copper-titanium alloy.

#### Sizes

Standard Sheets
Lengths—8', 10', 12', 14'
Widths—20", 24" and 28"
Gauges—.020, .027, .032 and .040
Non-standard Sheets
Lengths—Up to 14'
Widths—1" to 28"
Gauges—.010 to .250

#### Weights

.020"— .75 lb. per square foot .027"—1.00 lb. per square foot .032"—1.20 lb. per square foot .040"—1.50 lb. per square foot

#### Color

Microzinc 70 is preweathered to a gray patina equal to the natural aging process normally requiring one year exposure. Requires no painting or maintenance but can be painted.

#### **Applicable Standards**

Microzinc 70 conforms to Federal Specifications QQZ100A for zinc alloys and HUD specifications for metal roofing.

#### **Technical Data & Physical Properties**

See tables on opposite page.

#### Installation Method

Install in accordance with Microzinc 70 systems specifications and standard sheet metal practices.

#### **Forming**

Form with conventional hand and sheet metal shop tools. Can cut with shears, hand snips or power tools. Must be formed at temperatures of 50°F. and higher.

#### Soldering

Easily soldered with standard 50-50 solder and commercial non-corrosive flux or cut muriatic acid. All residual flux must be removed after soldering and neutralized by flushing with a water/bicarbonate of soda solution.

#### Minimum Gauge Recommendation

	Minimum
Standing seam roof	.027"
Batten seam roof	.027"
Mansard	.027"
Copings	.027"
Edge strips	.027"
Gravel stops	.027"
Flashings	
—through wall	.020"
—closed valley	.027"
—open valley	.032"
—wood or asphalt shingle	.020"
Louvers	
—frames	.032"
—slats under 6'	.032"
—slats over 6'	.040"



Estimating Data for	Microzinc 70 R	oofing System	Pan Requirem	ents (Based on 10'	sheet lengths)	
Specification				Style		
		1" Standing Sear			' x 1-7/8" Batter	Seam
Size & gauge	20"x120"x.027"	24"x120"x.027"	28"x120"x.027"	20"x120"x.027"	24"x120"x.027"	28"x120"x.027
Area per sheet	16.66 sq. ft.	20 sq. ft.	23.33 sq. ft.	16.66 sq. ft.	20 sq. ft.	23.33 sq. ft.
Amount of material subtracted from sheet width for seam	2-3/16"	2-3/16"	2-3/16"	4-1/16"	4-1/16"	4-1/16"
Width of formed pan	17-13/16"	21-13/16"	25-13/16"	15-15/16"	19-15/16"	23-15/16"
Distance between seam centers	18-1/16"	22-1/16"	26-1/16"	17-13/16"	21-13/16"	25-13/16"
Area covered by each sheet	14.864 sq. ft.	18.155 sq. ft.	21.697 sq. ft.	14.658 sq. ft.	17.95 sq. ft.	21.24 sq. ft.
No. of sheets required per 100 sq. feet	6.72 (1)	5.5 (1)	4.6 (1)	6.82 (2)	5.57 (2)	4.7 (2)
Sheet Weight	16.66 lbs.	20 lbs.	23.33 lbs.	16.66 lbs.	20 lbs.	23.33 lbs.

Comparison With C	Other Metals						
			Me	tal or Alloy			
Property	Microzinc 70 Zinc-Copper- Titanium Alloy	Copper 110 Cold Rolled 1/8 Hard	Lead Coated Copper	Terne 40 Lb.	Aluminum 3003-H14 Painted 20-Yr. Guar.	Stainless Steel	Terne Coated Stainless
Coefficient of Thermal Expansion 32°-212°F. (in/in/°F. <sup>10-6</sup> )	13.8 with grain 10.8 cross grain	9.3	9.3	6.5	12.8	9.6	9.6
Tensile Strength (psi)	24,000 with grain 28,000 cross grain	36,000	35,000	58,000	22,000	84,000	80,000
Elongation (% in 2")	50 with grain 25 cross grain	30	30	29	8	60	50
Hardness	25 Cross gram 58	65	65	78	49	85	85
(Rockwell 15-T)	30		.321	N/A	.099	.288	N/A
Density (lbs/in³)	.259	.321			.45 lbs./	.76 lbs./	.71 lbs./
Relative Weight per	1.00 lbs./	1.00 lbs./ sq. ft.	1.15 lbs./ sq. ft.	.65 lbs./ sq. ft.	sq. ft.	sq. ft.	sq. ft.
eq. ft. at Compa- rable Thickness (1)	sq. ft.	16 oz. .022 thick	16 oz. .022 thick	.018 thick	.032 thick	.018 thick	.015 thick
The Time Control (1)	.027 thick	,UZZ tilick			55	65	100
Comparative Cost	60	100	111	30	33	-	

Source for metallurgical data—Metals Handbook—American Society For Metals—8th Edition—Volume 1.

(1) Manufacturers commonly recommended thicknesses.

(2) Relative cost (copper=100), based on mill base selling prices as of July, 1972.

### Microzinc 70™ Warranty Information

Ball Metal & Chemical, Division of Ball Corporation ("Ball") guarantees that purchased preweathered Microzinc 70 products made by Ball were manufactured of good material and workmanship according to Ball's specifications. Ball guarantees that such purchased preweathered Microzinc 70 products will not leak as a result of normal atmospheric corrosion for

a period of twenty (20) years after date of installation as roofing material. The pre-weathered finish will not peel, crack, chip, or spall. The twenty (20) year Microzinc 70 guarantee will be validated by an authorized official of Ball Metal & Chemical only upon inspection for compliance with application procedures as detailed in this revised catalog (No. 75A).

#### Regional Architectural Sales Representatives

Atlanta, Georgia H. A. Redmond 4724 Dogwood Farm Road Lithonia, Georgia 30058 (404) 981-3823

Baltimore, Maryland W. F. Lomas, Jr. 1117 Longbrook Road Lutherville, Maryland 21093 (301) 823-6540

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Write or call your nearest Ball representative



### Metal & Chemical Division

GREENEVILLE, TENNESSEE 37743/(615) 639-8111

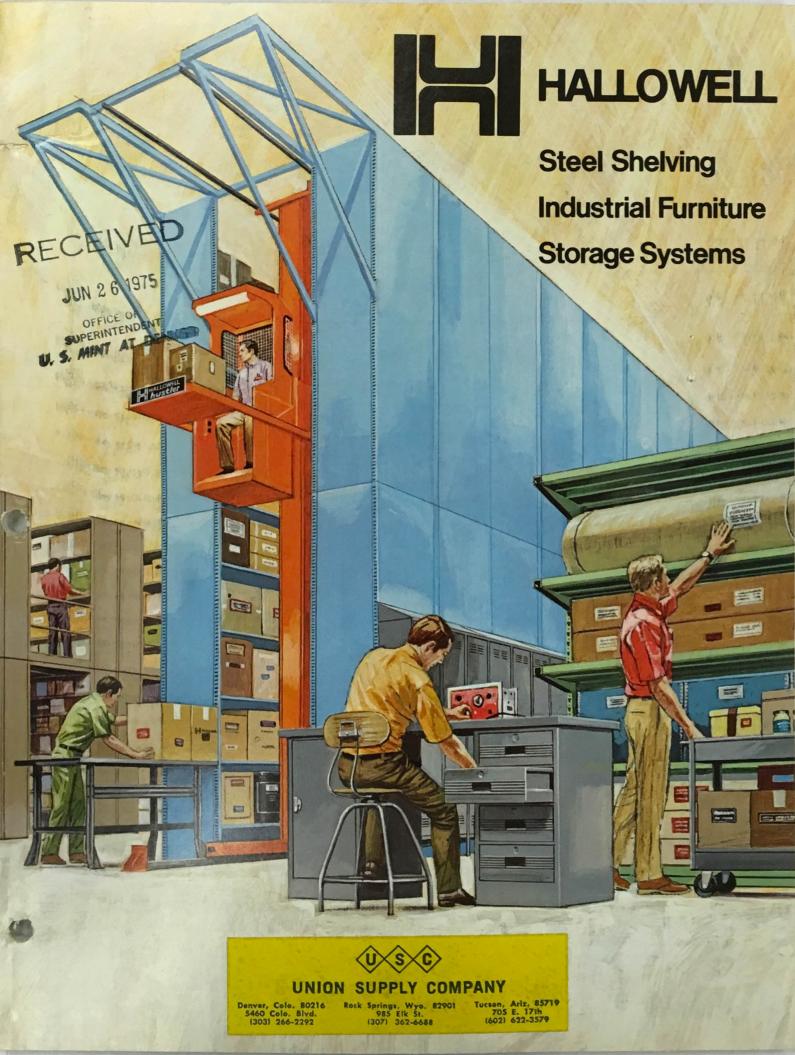
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## UNION SUPPLY COMPANY

A/C 303 266-2292

WILLIAM E. SLOAN

BOX 16388 · DENVER, COLORADO 80216 5460 COLO. BLVD., COMMERCE CITY, COLORADO 80022

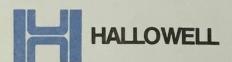


#### Dear Reader.

This is a combination catalog, buyers' guide, and reference manual for users of steel shelving and storage systems, steel shop equipment and industrial furniture.

It has been prepared by Hallowell to provide within a single document all the reference material and catalog information needed to make a proper selection in the product areas covered. The table of contents and index have been organized to enable rapid identification and location of the information contained in the catalog — data on models, component parts, shelf loading capacities, bracing arrangements, floor plans, multi-level storage systems, and the like.

We think you will find this the most comprehensive catalog yet published in our industry. If further advice on our products or their use is required, please contact your Hallowell supplier.



The Storage System People



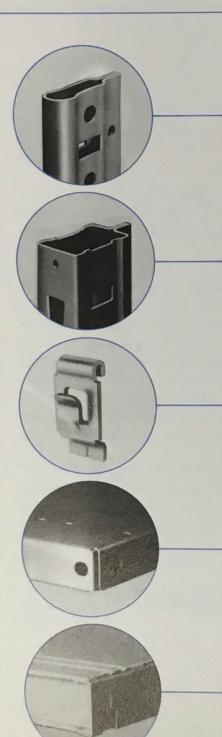
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#### **FIVE KEY COMPONENTS**

shelving the most versatile storage system available today.



#### **ERECTOMATIC FLUSH BEADED POSTS**

Beaded for strength. Flush to permit straight-in/straight-out shelf installation or shelf changing. No tilting. Get full use of shelf area. Pierced on 1-1/2" centers to allow positioning of one shelf independently of other shelves.

#### **ERECTOMATIC HEAVY DUTY H-POSTS**

All the advantages of Flush Beaded Posts plus more than 2 times the load-carrying capacity. These heavy duty posts are common to front or rear and can support high rise or high density storage systems using standard Erectomatic components throughout.

#### **ERECTOMATIC ONE-PIECE SHELF CLIPS**

Each shelf requires four of these sturdy and compact clips. They key snugly into post slots to hold standard or widespan shelves securely in place. Fit either Flush Beaded Posts or H-Posts. Provide independent shelf positioning on 1-1/2" centers.

#### **ERECTOMATIC SHELVES (STANDARD)**

Triple flanged for greater strength with lapped and welded corners. Available in three load capacity classes, up to 48" spans and 36" depths. Pierced on 1" centers to accept dividers. Take standard one-piece clips. Use with either Flush Beaded Posts or H-Posts. Can be independently installed or re-positioned.

#### **ERECTOMATIC WIDESPAN SHELVES**

The patented\*, integral roll formed I-beam cross section of the leading edges of these shelves are able to carry significantly higher loads over 72", 84", and 96" spans without the need for intermediate posts or separately installed reinforcing components. Can be independently installed or repositioned with the universal Erectomatic one-piece, shelf clip.

\*U.S. Patent No. 3,556,309



Here are just a few of the benefits you get from ERECTOMATIC'S versatility.

#### **ERECTOMATIC SHELVING**

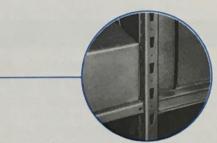
#### **FAST ASSEMBLY**

ERECTOMATIC pre-engineered, prefabricated components cost less to buy and substantially less to erect.



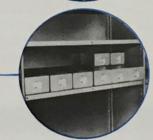
#### ADDED SAVINGS WITH COMMON PARTS

Common backs and side panels for closed type shelving, and common back and side braces for open type shelving add to ERECTOMATIC economies. Also speed assembly.



#### **FULL USE OF SHELF AREAS**

eliminate sharp, ragged edges and enable full use of shelf widths for storage. No dead space behind the post.



#### INDEPENDENT SHELF POSITIONING

You get straight-in/straight-out shelf installation or repositioning. Even when shelf is loaded. No tilting is necessary. All shelves are adjustable independently of each other.



ADD, SUBTRACT, MULTIPLY OR DIVIDE. An ERECTOMATIC shelving system is as flexible as your storage needs. You can start with a single-tiered system today. Go high density, multi-level or high rise tomorrow. Or, even create a customized storage system of your own using standard bin fronts, dividers, shelf boxes, storage drawer units, or other standard parts.

ERECTOMATIC shelving components have been designed to guard against obsolescence. All are compatible, interchangeable, easily adjustable, and expandable--today, tomorrow or years from now. This point is illustrated in Table I which shows the various types of shelving systems that can be obtained by using standard ERECTOMATIC components.

Component Description	Standard Shelving	High Density	Cantilever	Multi-Level	High Rise
Beaded Post	•	•		•	•
H-Posts	•	•	•	•	•
Steel Strap Cross Braces	•	•	•	•	•
Closed Side Panels	•	•		•	•
Closed Back Panels	•	•		•	•
Standard Shelves	•	•	•	•	•
Erectospan Shelves	•	•	•	•	•
Dividers	•	•		•	•
Shelf Boxes	•	•		•	•
Doors	•	•			•
Storage Walls	•	•		•	•
Shelf Clips	•	•	•		•



#### SHELF CAPACITY INFORMATION

ERECTOMATIC shelves are available in four load capacity classes for use with ERECTOMATIC flush beaded front posts or ERECTOMATIC H-posts. Construction features for each shelf class are shown below along with load capacity ratings for each class.

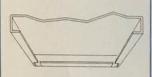
CLASS 0 For Normal Loads

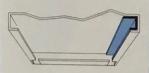
CLASS 1

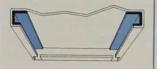
CLASS 2 For Medium Loads

CLASS 3 For Heavy Loads Standard Shelving (Beaded Front Posts)

CLASS 3 **High Density Shelving** (H-Posts)











#### DESCRIPTION

Standard ERECTOMATIC shelf with no reinforcing channels. Formed from 18 gauge cold rolled steel. Triple flanged at front and rear edges; box flanged on sides. All corners are lapped and welded for maximum strength.

Standard ERECTO-MATIC shelf with a 12 gauge, 1" x 1 1/8" x 5/16" reinforcing channel in front flange to protect against impact loads.

TARIEU CHELELOAD

Standard ERECTO-MATIC shelf with two 12 gauge, 1" x 1 1/8" x 5/16" reinforcing channels, one in front flange and one in rear flange, to increase load carrying capacity.

Same as Class 2 with two additional reinforcing channels for center support and two 13 gauge shelf support braces. (Part No. 5134) Provides maximum capacity for extra heavy loads. (For Class 3 bottom shelf support, use Part No. 5135 in lieu of shelf support braces.)

Same as Class 2 with two additional reinforcing channels for center support and two 13 gauge shelf support braces (Part No. 5136), Provides maximum capacity for heavy loads. (For Class 3 bottom shelf, use Part No. 5135 in lieu of shelf support braces).

	SHEEL LOADING CHART	FURSIANDARD	AND HIGH DENGITY	CHELVING W.	
CHELE			WAS LIIGH DEMOLL	SHELVING (IDS.)	

APPROXIMATE SHELF				MOAND AND HIGH DENSITY SHELVING (Ibs.)			
DEFLECTION	DEFLECTION ACROSS FRONT FLANGE CLASS 0 OR 1 CLASS 2 OR 3		CLASS 0 OR 1	CLASS 2	CLASS 3		
5/16"	5/16''	36" x 12" 36" x 15" 36" x 18" 36" x 24"	700 700 700 700	1200 1200 1300 1350			
	3/16"	36" × 30" 36" × 36"	600 425	700	2000 2000		
5/16"	7/16"	42" x 12" 42" x 18" 42" x 24"	425 425 425	1200 975 975	1600 1600		
1/4"	1/4"	42'' × 30'' 42'' × 36''	550 450	800 750	1600 1600		
5/16"	7/16"	48" × 12" 48" × 18" 48" × 24"	275 325 325	650 875 700	- 1200 1200		
1/4"	5/16"	48" × 30" 48" × 36"	325 325	650 650	1200 1200		
NOTES	All Tigures show	AID are chalf to		AND DESCRIPTION OF THE PERSON			

s shown are shelf load capacities for evenly distributed loads and include a safety factor of 1.65. Figures in shaded areas not applicable to ERECTOMATIC standard shelving.

Class 2 and 3 does not apply to cantilever shelving,

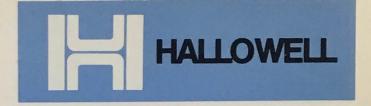


TABLE III WIDESPAN SHELF LOADING (Ibs)							
Depth	72" Width	84" Width	96" Width				
18"	1300	900	775				
24''	1200	1050	700				
30"	1500	1250	800				
36"	1400	1000	1000				
Deflection = 1/180 of span	400	.465	.533				

NOTE: Figures are based on evenly distributed loads. Safety factor: 1.65
Load Rating: Above do not apply to cantilever shelving.

All Hallowell shelf load ratings include a safety factor of 1.65. For example, a shelf with a catalog rating of 700 lbs. actually was designed and tested to a capacity of 1150 lbs.

#### Shown another way:

Design Capacity as confirmed by testing	1155 lbs.
Divide by safety factor	1.65
Catalog capacity rating	700 lbs.

Length	Maximum Uniform Load per Pair of Beams*	Deflection		
6′	2000 lbs.	.281		
7'	1750 lbs.	.328		
7′	1750 lbs.	.32		

NOTE: One tie bar required for 6' beams, two for 7' and 8' beams. (Safety Factor—1.65)

\* When beams are used in conjunction with corrugated deck panels (Part No. 5031), uniform distributed load capability remains the same as shown for beams.

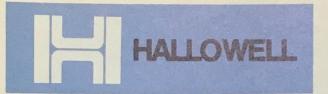
Depending on the type of material stored, there is always a risk that the actual load may exceed the planned load. The safety factor is for added protection.

All shelf load capacities are based on evenly distributed static (fixed) conditions. If the method of shelf loading (i.e. mechanical loading, drop loading) anticipated could impose dynamic (impact) loads on the shelving, consult Hallowell for more specific load limit recommendations.

TABLE V P	RODUCT DENSITY	Storage Capability of	Shelving in Pounds per	Available Cubic Feet
-----------	----------------	-----------------------	------------------------	----------------------

								CI			Class 3 Shelf														
Standard Clip Type Available Cubic Feet per Shelf				Maximum Product Density (lbs. per Cubic Foot)					Maximum Product Density (lbs. per Cubic Foot)						Maximum Product Density (lbs. per Cubic Foot)										
	Shel						Uniform	Shelf Centers				Uniform	Shelf Centers					Uniform	Shelf Centers						
	Width	Depth	12"	18"	24"	30"	36"	Load (lbs/shelf)	12"	18"	24"	30"	36"	Load (lbs/shelf)	12"	18"	24"	30"	36"	(lbs/shelf)	12"	18"	24"	30"	36"
	36''	12" 15"	2.4	3.9	5.4 6.8	6.9 8.6	8.4 10.5	700 700	292 233	179 143	130 103	101 81	83 67	1200 1200	500 400	308 245	222 176	174 139	143 114	_	-	-	-	-	-
	36"	18"	3.6	5.9	8.1	10.4	12.6	700	194	119	86	67	55	1300	361	220	160	125	103	2000	535	325	238	186	151
	36"	24" 30"	4.8	THE PERSON NAMED IN	13.5	13.8 17.75 20.7		700 600 425	146 100 60	90 61 36	65 44 23	51 34 20	42 34 17	1350 700 –	281 117 -	173 72 -	125 52 -	98 39 -	80 33 -	2000 2000 2000	410 330 278	206	186 148 110	146 115 97	117 97 77
	36" 42" 42"	36" 12" 18"	2.8	4.6 6.8	6.3	8.1 12.1	9.8 14.7 19.6	425 425 425	152 101 76	93 62 47	67 45 34	52 35 26	43 29 22	1200 975 975	428 232 174	261 143 107	190 104 77	148 81 61	122 66 50	- 1600 1600	- 378 285		- 173 128	- 134 99	- 110 81
	42" 42" 42"	30" 36"	5.6 7.0 8.4	11.4	15.75	20.5	24.5 29.4	550 450	78 53	48	35 24	27 19	22 15	800 750	114 89	70 55	51 39	39 31	33 26		227 192	139 116	102 84	81 67	64 56
	48" 48" 48"	12" 18" 24"	3.2	5.2 7.8	7.2 10.8	9.2 13.8	11.2 16.8 22.4	275 325 325	86 68 51	53 42 31	38 31 22	30 23 18	24 15 14	650 875 700	203 182 109	125 112 67	90 81 49	71 63 38	58 52 31	- 1200 1200	- 249 186		- 101 84	- 87 66	- 72 54
9	48" 48"	30"	Acres Maria				28.0 33.6	325 325	41 34	25 21	18 15	14 12	12 10	650 650	81 68	50 42	36 31	28 24	23 19		150 123	5.00	66 54	54 45	42 36

NOTE: Figures in shaded area not applicable to ERECTOMATIC standard shelving.



#### UNIT LOAD CAPACITY INFORMATION

Before selecting type of post, consideration should be given to loads to be carried. Use the formula below to get unit load, then select post type from table. (Refer to shelf loading charts on Pages 4 and 5 for maximum safe shelf loads.)

(B-2)xA = Unit Load, where

A = Shelf Load (see Note 2)

B = Shelves per unit (includes top and bottom shelves)

To determine the number of shelf spaces (12", 18", 24", 30" etc.) divide the nominal post height -3" by the desired space. Shelf spacings must be multiples of 1 1/2".

Number of shelf spaces + 1 = number of shelves per unit. (B)

Notes:

1. Use H-Posts for:

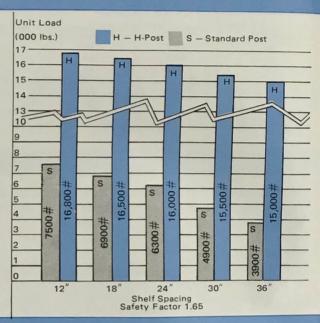
Hallowell "HUSTLER" applications.

High-rise applications.

Pass-through applications regardless of load.

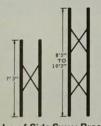
High-density, multi-level applications.

When using horizontal beams, a pair of beams is considered a shelf. Beam spacings are in multiples of 3".

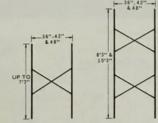


#### TYPICAL SWAY BRACE INSTALLATIONS FOR SEISMIC ZONE NO. 1

#### STANDARD SHELVING (Beaded Front Posts)



Use of Side Sway Braces (Part No. 5340) with standard and/or widespan shelves

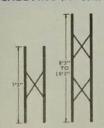


Use of Back Sway Braces (Part No. 5342) with standard shelves

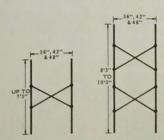


Use of Back Sway Braces (Part No. 5343) with widespan shelves

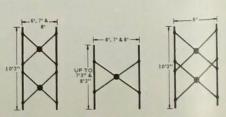
#### HIGH DENSITY SHELVING (H-Posts)



Use of Side Sway Braces (Part No. 5341) with standard and/or widespan shelves



Use of Back Sway Braces (Part No. 5342) with standard shelves



Use of Back Sway Braces (Part No. 5343) with widespan shelves

- NOTES: 1. When splicing posts for increased heights or for multi-level shelving, use the proper number of braces required for the height of the post being added. Example: a 10'3" model increased another 10'3" in height would require 4 sets of side sway braces and 4 sets of back sway braces.
  - 2. For additional bracing requirements in Seismic Zones No. 2 and No. 3, consult the Hallowell Applications Engineering Department.

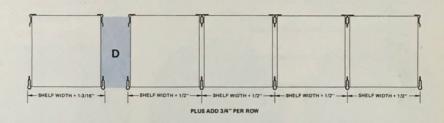


#### FLOOR PLAN INFORMATION

#### STANDARD SHELVING WITH STANDARD SHELVES

For "D" - Single Face add 3/16" to nominal shelf depth.

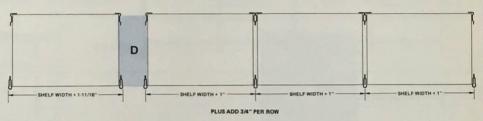
For "D" - Double Face add 3/8" to nominal shelf depth.



#### STANDARD SHELVING WITH WIDESPAN SHELVES

For "D" - Single Face add 3/16" to nominal shelf depth.

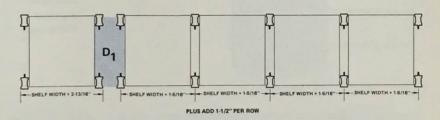
For "D" - Double Face add 3/8" to nominal shelf depth.



#### HIGH DENSITY SHELVING WITH STANDARD SHELVES

For "D<sub>1</sub>" - Single Face add 5/16" to nominal shelf depth.

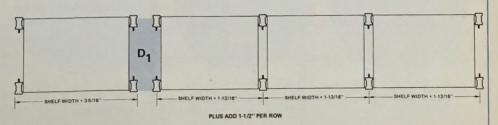
For "D<sub>1</sub>" - Double Face add 13/16" to nominal shelf depth for closed models, and 29/32" for open models.



#### HIGH DENSITY SHELVING WITH WIDESPAN SHELVES

For "D<sub>1</sub>" - Single Face add 5/16" to nominal shelf depth.

For "D<sub>1</sub>" - Double Face add 13/16" to nominal shelf depth for closed models, and 29/32" for open models.



NOTE: Widths of ERECTOMATIC posts should be added to the nominal shelf width in any floor plan to determine the overall shelving width. Check "D" and "D<sub>1</sub>" dimensions for depth creepage.



#### LOCATION OF HORIZONTAL BEAMS

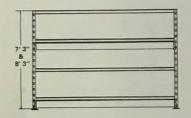
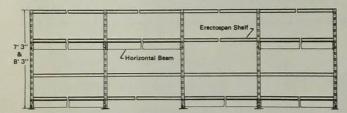


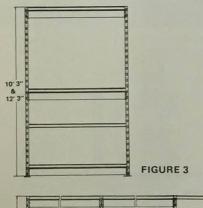
FIGURE 1



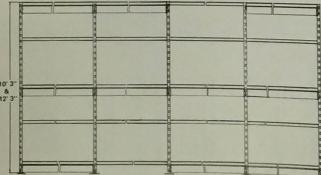
For individual models 7'3" and 8'3" high, two pair of horizontal beams are required. One pair located directly below bottom shelf; the other should be about 1/3 of the unit height down from the top, directly below a shelf in that area. (See Fig. 1.)

For continuous 7'3" and 8'3" high models, starting and ending units should be assembled as above and beams should be placed alternately between bottom location and upper location on all intermediate units. (See Fig. 2.)

FIGURE 2



For models 10'3" and 12'3" high, three pair of horizontal beams are required. One pair each is located directly below top and bottom shelves; the third pair, directly below a shelf near the center of the unit. (See Fig. 3.)



For continuous 10'3" and 12'3" high models, starting and ending units should be assembled as above. Intermediate units should have two pair of beams alternating between bottom and center locations and top and center locations. (See Fig. 4.)

FIGURE 4

NOTE:

Danger of overturning must be considered in shallow depth models, particularly 18" and 24" depths. When mounting foot plates, place the mounting hole to the outside of posts on starting and ending models. For intermediate models where beam is not in the bottom position, separately.

# ERECTOMATIC STANDARD SHELVING WITH FLUSH BEADED FRONT POSTS Models are available in a wide variety of functional

types — open, closed, bin, drawer or box, ledge, counter, cabinet, widespan, and document storage — just to name a few. All are fully described in this section of the catalog along with a complete component parts list.

Because of the versatility and interchangeability of standard ERECTO-MATIC parts, any ERECTOMATIC shelving model can at any time be modified or customized to precisely fill present or future operational requirements. The possibilities are as broad as your imagination; the storage capabilities, as specific as your needs.



### **ERECTOMATIC STANDARD SHELVING**

### How ERECTOMATIC shelving can be changed for changing needs.

Transform standard shelves into storage bins by adding bin fronts, partial dividers, full dividers and label holders.



Install sloping shelves and partial dividers for efficient storage and withdrawal of tools, drills, taps, reamers, etc.



Install shelf boxes and small drawer inserts for small parts storage. Get extra load capacity with shelf reinforcing channels and shelf support braces.



Add swinging or sliding doors to closed-type shelving and get cabinet-type storage, fully enclosed and lockable.

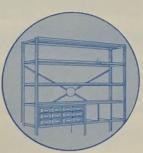








Or, add ledge shelves, ledge panels and swinging or sliding doors and get a work station with enclosed, lockable storage in the bottom compartment.



Add on widespan shelves—72", 84", or 96" spans with no intermediate posts needed—to handle bulky and irregular shaped storage items.

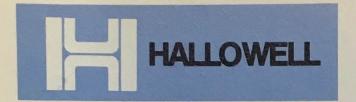


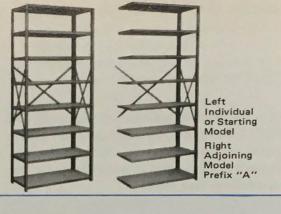
Switch to document storage. Just install open shelf file dividers with divider supports and a sliding reference shelf and you have it.



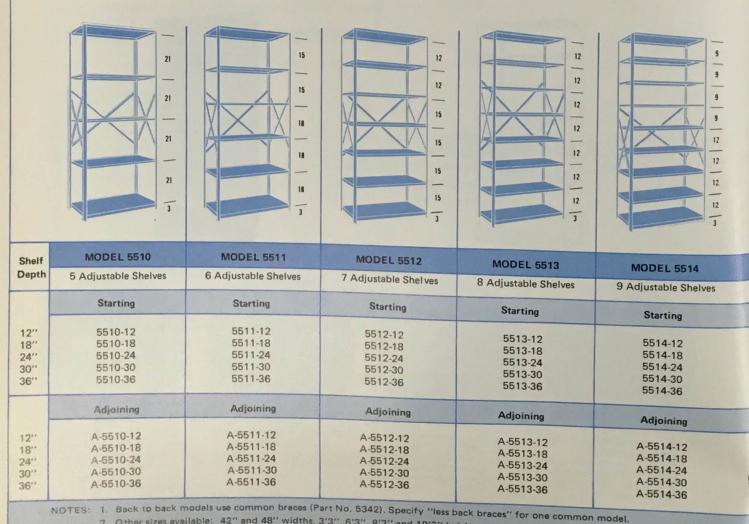
Create counter space with storage capability. Add on continuous counter-type shelving. 3'3" high, with counter tops, end caps, and counter fronts.

ALL COMPONENTS ARE STANDARD PARTS IN THIS CATALOG AND CAN BE APPLIED TO ANY **ERECTOMATIC** STANDARD SHELVING MODEL

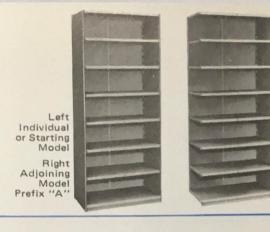




OPEN MODELS Economical method of storing packaged or bulky items. Models are 36" wide, 7'3" high, in depths shown. All shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4).

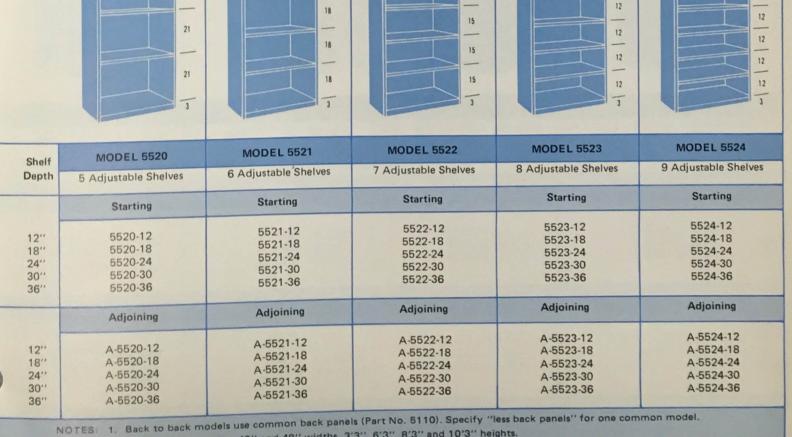


- - 2. Other sizes available: 42" and 48" widths, 3'3", 6'3", 8'3" and 10'3" heights.





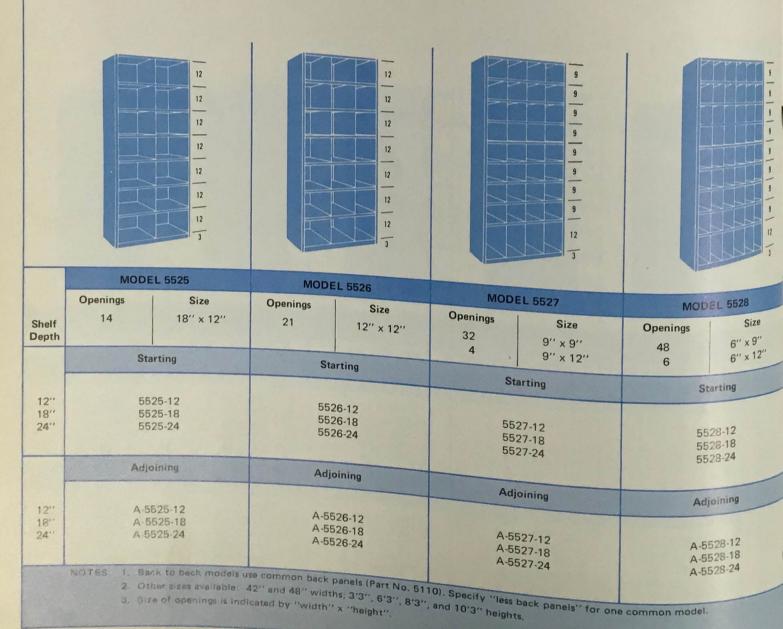
CLOSED MODELS Enclosed at back and sides with sturdy one-piece panels for extra protection and cleaner, neater storage. Base strips included. Models are 36" wide, 7'3" high, in depths shown. All shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4).



2. Other sizes available: 42" and 48" widths, 3'3", 6'3", 8'3" and 10'3" heights.

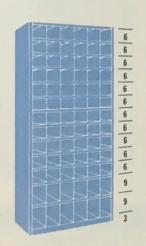


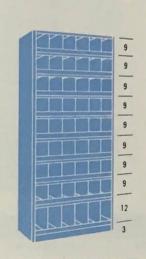
BIN MODELS For efficient storage of smaller parts and packaged goods. Enable quick, easy access to materials stored. Save time in locating and picking stock. Models are 36" wide, 7'3" high, in depths shown. Enclosed at back and sides. Base strips included. All shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4.)

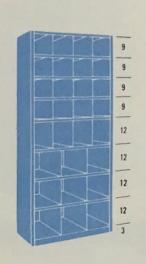


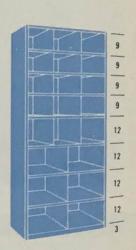


**BIN MODELS (Continued)** 









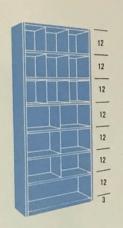
	MODEL 5529		MODEL 5530		MODEL 5531		MODEL 5532	
Shelf Depth	Openings 66 12	Size 6'' × 6'' 6'' × 9''	Openings 48 6 All with 3" h	Size 6" × 9" 6" × 12" igh bin fronts	Openings 16 4 9	Size 9" x 9" 9" x 12" 12" x 12"	Openings 12 3 6	Size 12" × 9" 12" × 12" 18" × 12"
	Starting		Star	ting	Start	ing	Star	ting
12" 18" 24"	5529 5529 5529	1-18	5530-12 5530-18 5530-24		5531-12 5531-18 5531-24		5532-12 5532-18 5532-24	
	Adjo	ining	Adjoi	ning	Adjoining		Adjoining	
12" 18" 24"	A-5529-12 A-5530-12 A-5529-18 A-5530-18		A-5531-12 A-5531-18 A-5531-24		A-5532-12 A-5532-18 A-5532-24			

NOTES: 1. Back to back models use common back panels (Part No. 5110). Specify "less back panels" for one common model.

- 2. Other sizes available: 42" and 48" widths; 3'3", 6'3", 8'3", and 10'3" heights.
- 3. Size of openings is indicated by "width" x "height".



### **BIN MODELS (Continued)**



Adjoining

A-5533-12

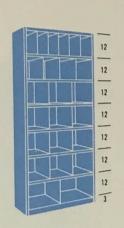
A-5533-18

A-5533-24

12"

18"

24"



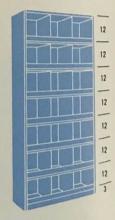


Adjoining

A-5535-12

A-5535-18

A-5535-24



Adjoining

A-5536-12

A-5536-18

A-5536-24

	MODEL 5533	MODEL 5534	MODEL 5535	MODEL 5536
Shelf Depth	Openings         Size           9         12" × 12"           6         18" × 12"           1         36" × 12"	Openings         Size           6         6" x 12"           4         9" x 12"           12         12" x 12"           2         18" x 12"	Openings         Size           12         9" × 9"           6         6" × 9"           12         6" × 6"           6         12" × 12"           2         18" × 12"	Openings Size  21 with 3" high bin fronts
	Starting	Starting	Starting	Starting
12" 18" 24"	5533-12 5533-18 5533-24	5534-12 5534-18 5534-24	5535-12 5535-18 5535-24	5536-12 5536-18 5536-24

- NOTES: 1. Back to back models use common back panels (Part No. 5110). Specify "less back panels" for one common model. 2. Other sizes available: 42" and 48" widths; 3"3", 6"3", 8"3", and 10"3" heights.

Adjoining

A-5534-12

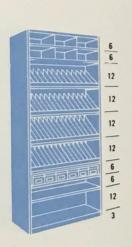
A-5534-18

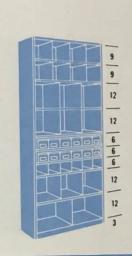
A-5534-24

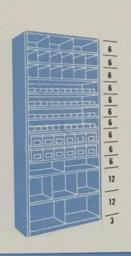
3. Size of openings is indicated by "width" x "height".

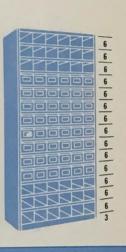


DRAWER AND BOX MODELS Ideal for safe, convenient storage of drills, reamers, fasteners and other small parts. Boxes and drawers can be easily removed and taken to work station. Models are 36" wide, 7'3" high, in depths shown. All shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4.)









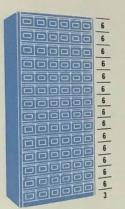
	MODEL 5537	MODEL 5538	MODEL 5539	MODEL 5540	
Shelf Depth	Openings   Size  6	Openings   Size 8   9" x 9" 9   12" x 12" 6   6" x 6" 2   18" x 12" 12 shelf boxes, 5-7/8" wide with 2 dividers each	Openings   Size	48 shelf boxes th 5-7/8" wide with 2 dividers each	
12'' 18'' 24''	5537-12 5537-18 5537-24	5538-12 5538-18 5538-24	5539-12 5539-18 5538-24	5540-12 5540-18 5540-24	
	Adjoining	Adjoining	Adjoining	Adjoining	
12" 18" 24"	A-5537-12 A-5537-18 A-5537-24	A-5538-12 A-5538-18 A-5538-24	A-5539-12 A-5539-18 A-5539-24	A-5540-12 A-5540-18 A-5540-24	

NOTES: 1. Base strips included on all units.

- 2. Back to back models use common back panels (Part No. 5110). Specify "less back panels" for one common model.
- 3. Size of openings is indicated by "width" x "height".

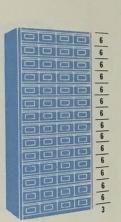


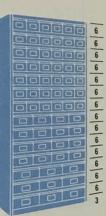
DRAWER AND BOX MODELS (Continued)



5541-24

A-5541-24





5543-24

A-5543-24



5544-18

A-5544-18

MODEL 5541				
		MODEL 5542	MODEL 5543	MODEL 5544
Shelf Depth			Openings Size  42 shelf boxes, 5-7/8" wide 16 shelf boxes, 8-3/4" wide 9 shelf boxes, 11-5/8" wide each with 2 dividers	A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Starting	Starting	Starting	Starting
12" 18"	5541-12 5541-18 5541-24	5542-12 5542-18 5542-24	5543-12 5543-18	- FEAA 10

Adjoining Adjoining Adjoining Adjoining A-5541-12 A-5542-12 12" A-5543-12 A-5542-18 A-5541-18 18" A-5543-18

5542-24

A-5542-24

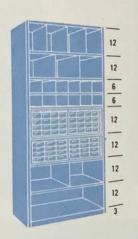
- NOTES: 1. Units are 36" wide, 7'3" high in depths shown. All shelves are Class 0.
  - 2. Base strips included on all units.
  - 2. Bask to back models use common back panels (Part No. 5110). Specify "less back panels" for common models.

24"

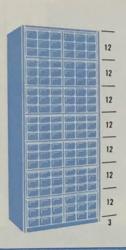
24"



DRAWER AND BOX MODELS (Continued)







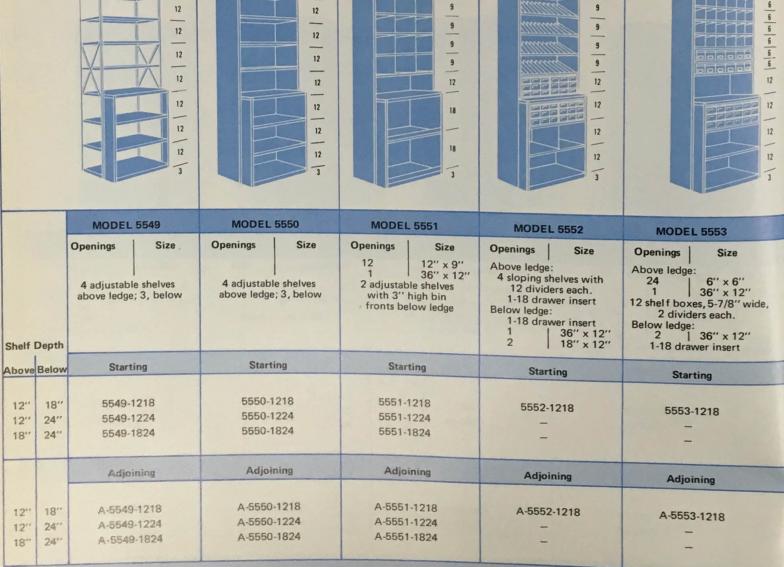


	MODEL 5545		MODEL 5545 MODEL 5546		MODEL 5547		MODEL 5548	
Shelf Depth	Openings  4 3 12 2 1 1-32 & 1-24 d	9" x 12" 12" x 12" 6" x 6" 18" x 12" 36" x 12" rawer inserts	Openings 2 6 1 1-32, 1-24, drawer	Size  18" × 12"  12" × 6"  36" × 12"  1-18 & 1-12  inserts	Openings 7-18 draw	Size er inserts	Openings  18 3 2 1 1 milling o	6" x 6" 12" x 12" 18" x 9" 36" x 9" cutter insert
Starting		ting	Starting		Starting		Starting	
12" 18"			5546-12 5546-18		5547-12 5547-18		5548-12 5548-18	
			Adjoining		Adjoining		Adjoining	
12" A-55		45-12 45-18	A-554 A-554		A-5547-12 A-5547-18		A-5548-12 A-5548-18	

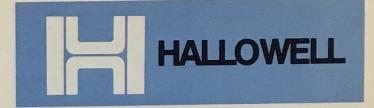
- NOTES: 1. Units are 36" wide, 7'3" high in depths shown. All shelves are Class 0.
  - 2. Base strips are included on all models.
  - 3. Back to back models use common back panels (Part No. 5110). Specify "less back panels" for common models.
  - 4. Size of openings is indicated by "width" x "height".



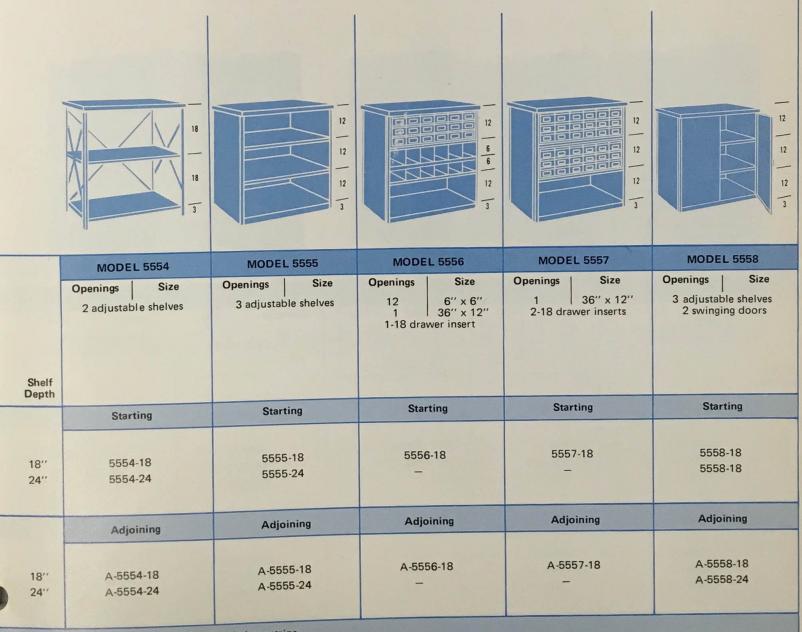
LEDGE MODELS Combine storage space with a work surface. Models are 36" wide, 7'3" high, in depths shown. Shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4).



- NOTES: 1. Closed models include base strips.
  - Closed models include case common back panels (Part No. 5110); open models, common back braces (Part No. 5342). Back to back, closed initials use common closed models, "less back braces" for common open models, specify "less back panels" for common open models,
  - Size of openings is indicated by "width" x "height",



COUNTER MODELS Provide compact storage with a counter top working surface. Models are 36" wide, 3'3" high, in depths shown. Shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4.)



NOTES: 1. Closed models include base strips.

2. Size of openings is indicated by "width" x "height".

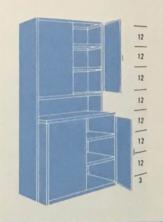


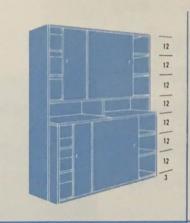
CABINET MODELS Completely enclosed with swinging or sliding doors. Doors are equipped with locks to provide security. Swinging doors have 3-point latching, chrome finished handles, and built-in lock. Sliding doors have cylinder lock; glide on nylon rollers and guides. Models are 7'3" high, in the widths and shelf depths shown. Shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4).

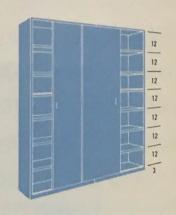
	15 18 18 18	6 6 6 9 9 9 9 9 12 12 12	12 12 12 12 12 12	6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	11 11 11 11 11 11 11 11 11 11 11 11 11	
	MODEL 5559	MODEL 5560	MODEL 5561	MODEL 5562		
Shelf Depth	Openings   Size 6 adjustable shelves 2 swinging doors	Openings Size 6 12" x 12" 4 9" x 12" 24 6" x 9" 12 6" x 6" 2 swinging doors	Openings Size  2 36" × 12" 3 12" × 12" 6 6" × 12" 1-32, 2-24 drawer inserts, 2 swinging doors	Openings Size 64 6" x 6" 2 swinging doors	MODEL 5563  Openings   Size 8 adjustable shelves 2 sets of swinging doors	
	Starting	Starting	Starting			
12" 18" 24"	5559-12 5559-18 5559-24	5560-12 5560-18 5560-24	5561-12 5561-18	5562-12 5562-18 5562-24	5563-12 5563-18 5563-24	
	Adjoining	Adjoining	Adjoining			
12" 18" 24"	A-5559-12 A-5559-18 A-5559-24	A-5560-12 A-5560-18 A-5560-24	A-5561-12 A-5561-18	A-5562-12 A-5562-18	A-5563-12 A-5563-18	
20	NOTES: 1. Base strips are 2. All models are 3. Back to back r 4. Size of openin	included on all models 36" wide. Other heights an models use common back par gs is indicated by "width" x	d depths are available. nels (Part No. 5110). Specify "height".	A-5562-24  "less back panels" for comm	A-5563-24 on models.	



### CABINET MODELS (Continued)





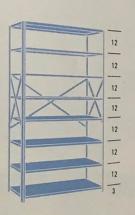


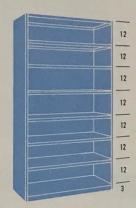
		MODEL 5564	MODEL 5565		MODEL 5566
Shelf I	Depth	36" wide 4 adjustable shelves above ledge 3 adjustable shelves below ledge 2 swinging doors	72'' wide 8 adjustable shelves above ledge 6 adjustable shelves below ledge 2 sets of sliding doors	Shelf Depth	72" wide 16 adjustable shelves 1 set of sliding doors
above	below	Starting	Starting		Starting
12" 12" 18"	18" 24" 24"	5564-1218 5564-1224 5564-1824	5565-1218 5565-1224 5565-1824	18" 24"	5566-18 5566-24
		Adjoining	Adjoining		Adjoining
12" 12" 18"	18" 24" 24"	A-5564-1218 A-5564-1224 A-5564-1824	A-5565-1218 A-5565-1224 A-5565-1824	18" 24"	A-5566-18 A-5566-24

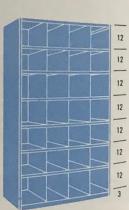
- NOTES: 1. Base strips are included on all models.
  - 2. Other heights and depths are available.
  - 3. Back to back models use common back panels (Part No. 5110). Specify "less back panels" for common models.



48" WIDE MODELS Provide efficient storage and greater shelf access for bulkier loads by reducing number of posts required. Models are 7'3" high in shelf depths shown. All shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4.)







	MODEL 5567	MODEL 5568	Money
Shelf Depth	0 11 11 1 1	8 adjustable shelves	MODEL 5569
	Starting	Starting	28 openings 12" x 12"
12" 18"	5567-12	5568-12	Starting
24" 30" 36"	5567-18 5567-24 5567-30 5567-36	5568-18 5568-24 5568-30 5568-36	5569-12 5569-18 5569-24
	Adjoining	Adjoining	-
12"	A-5567-12 A-5567-18	A-5568-12	Adjoining
24"	A-5567-24	A-5568-18 A-5568-24	A-5569-12
36"	A-5567-30 A-5567-36	A-5568-24 A-5568-30 A-5568-36	A-5569-18 A-5569-24

- NOTES: 1. Other heights available.
  - 2. Closed models include base strips.
  - 2. Closed models include base surply
    3. Back to back closed models use common back panels (Part No. 5110); open models, common back braces

    1. Closed models include base surply

    1. Closed models use common back panels (Part No. 5110); open models, common back braces Back to back closed models, common back braces (Part No. 5342). Specify "less back panels" for common closed models; "less back braces" for common open models.



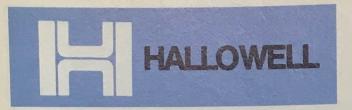
48" WIDE MODELS (Continued)

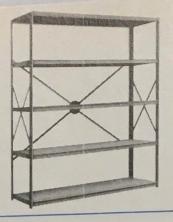




	MODEL 5570			MODEL 5571
Shelf Depth	6 adjustable shelves; 2 swinging doors		Depth	4 adjustable shelves above ledge; 3, below 2-sets of swinging doors.
	Starting	above below		Starting
12" 18" 24" 30" 36"	5570-12 5570-18 5570-24 5570-30 5570-36	12" 12" 18"	18" 24" 24"	5571-1218 5571-1224 5571-1824
12" 18" 24" 30"	Adjoining  A-5570-12  A-5570-18  A-5570-24  A-5570-30  A-5570-36	12" 12" 18"	18" 24" 24"	Adjoining  A-5571-1218  A-5571-1224  A-5571-1824

- NOTES: 1. All models are 7'3" high. Other heights are available.
  - 2. Shelves are Class 0 and can be easily reinforced. (See page 4.)
  - 3. Closed models include base strips.
  - 4. Back to back models use common back panels (Part No. 5110). Specify "less back panels" for common models.



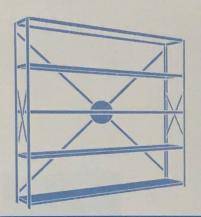




Individual or Starting Model Right

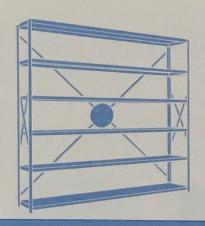
Adjoining Model Prefix "A"

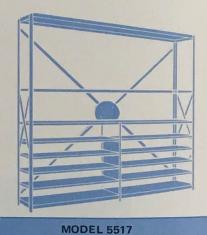
WIDESPAN MODELS 72", 84", and 96" wide. Carry up to 1000 lb. load capacity over a span up to 96" without need for intermediate posts. Provide a spacious and efficient storage area for long or unusually shaped, bulky, hand loaded items. All models are open type, 7'3" high, in the depths shown.



**MODEL 5515** 

4 openings 72", 84", or 96" wide.





Shelf	

M	m	13	6	15	и	8	
	•				ш	u	

5 openings 72", 84", or 96" wide.

2 openings at top 72", 84", or 96" wide. 10 openings at bottom

SI	nelf			36", 42", or 48" wide intermediate post is 3'3" high
Width	Depth	Starting	Starting	Starting
72''	18" 24" 30" 36"	5515-7218 5515-7224 5515-7230 5515-7236	5516-7218 5516-7224 5516-7230 5516-7236	5517-7218 5517-7224 5517-7230 5517-7236
84"	18" 24" 30" 36"	5515-8418 5515-8424 5515-8430 5515-8436	5516-8418 5516-8424 5516-8430 5516-8436	5517-8418 5517-8424 5517-8430
96"	18" 24" 30" 36"	5515-9618 5515-9624 5515-9630 5515-9636	5516-9618 5516-9624 5516-9630 5516-9636	5517-8436 5517-9618 5517-9624 5517-9630 5517-9636
		Adjoining	Adjoining	
72"	18" 24" 30" 36"	A-5515-7218 A-5515-7224 A-5515-7230 A-5515-7236	A-5516-7218 A-5516-7224 A-5516-7230 A-5516-7236	Adjoining  A-5517-7218  A-5517-7224  A-5517-7230
84"	18" 24" 30" 36"	A-5515-8418 A-5515-8424 A-5515-8430 A-5515-8436	A-5516-8418 A-5516-8424 A-5516-8430 A-5516-8436	A-5517-7236 A-5517-8418 A-5517-8424 A-5517-8430
96"	18" 24" 30" 36"	A-5515-9618 A-5515-9624 A-5515-9630 A-5515-9636	A-5516-9618 A-5516-9624 A-5516-9630 A-5516-9636	A-5517-8436 A-5517-9618 A-5517-9624 A-5517-9630
	NOTES: 1.	To order give model number, width a	and depth	A-5517-9636

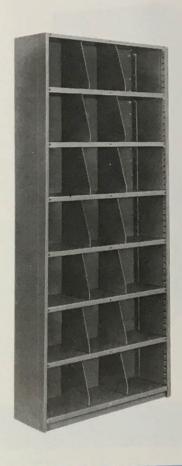
2. Back to back models use common back sway braces (Part No. 5343). Specify "less back sway braces" for common models.

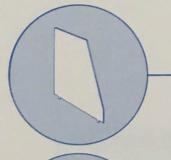
DOCUMENT STORAGE Any standard 36" wide x 12" or 15" deep ERECTOMATIC shelving model can be adapted to provide efficient open shelf filing of documents by the addition of standard components as shown below. (See page 32 for part numbers and dimensional data.)



### **ERECTOMATIC STANDARD SHELVING**

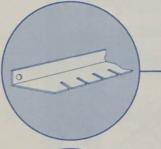
Complete document storage models are also available for the installation of a new system. Models are 7'3" high, 36" wide, in shelf depths of 12" and 15". Shelves are Class 0 and can be easily reinforced for additional capacity (See page 4).





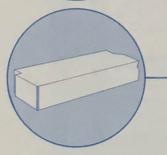
#### **OPEN SHELF FILE DIVIDER**

(Part No. 5585) For shelves in 12" and 15" depths, positioned on 12" centers to take standard height file folders. Fits standard shelf divider holes. 3-point positive positioning. Top rear section slides into divider support bracket slots. Flat and smooth. No obstruction to cause wear and tear on file folders. Easily repositioned on 1" centers across the shelves.

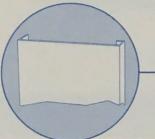


#### **DIVIDER SUPPORT BRACKET**

(Part No. 5586) Furnished with a single bolt and nut for attachment to center hole on rear flange of shelf to provide divider support. Adjustable on 1" centers. When used below reference shelf, can be bolted to rear posts and center of back panel.



EXTENDED BASE (Part No. 5587) Protects stored file folders from possible damage by aisle floor traffic. Enhances appearance of the storage model. Base strips not required when you use extended base.



FINISHED END PANEL (Part No. 5588) Encloses row ends. Provides a neat, clean, finished appearance. In painted metal. Self-edged plastic over particle board available upon request.

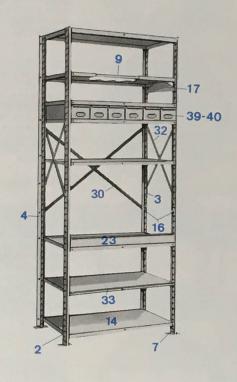
MODEL 5572	MODEL 5573	
shelf depth is 12" 8 adjustable shelves 2 dividers per shelf	shelf depth is 15" 8 adjustable shelves 2 dividers per shelf	
Starting	Starting	
5572-12	5573-15	
Adjoining	Adjoining	
A-5572-12	A-5573-15	

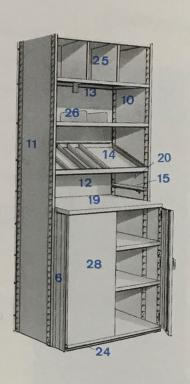
SLIDING REFERENCE SHELF (Part No. 5589) Provides a work surface that can be pulled out to hold a file folder for reference or to hold a stack of folders for refiling. Bolts to standard shelf through divider holes. Vertical opening below reference shelf must be 15" to allow for use of standard open shelf file dividers.



- NOTES: 1. Base strips included.
  - Back to back models use common back panels (Part No. 5110). Specify "less back panels" for common models.



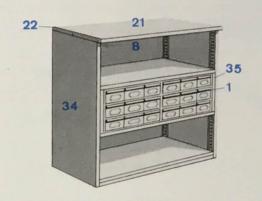


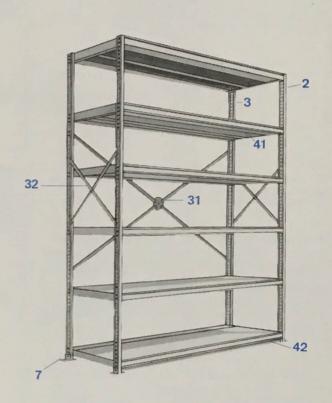


Key	Description	Part No.	Key	Description	Part No.
1 2 3 4 5 6 7 8 9	Drawer Insert  Beaded Front Post  Back Post  T-Post  Post Splice Channel (not shown)  Ledge Panel  Foot Plate  Counter Front  Shelf Reinforcing Channel  End Panel	1117 5002 5004 5006 5009 5012 5050 5070 5082 5092	11 12 13 14 15 16 17 18 19 20	T-Panel  Back Panel  Back Panel Clip  Standard Shelf  Shelf Support  Shelf Clips  Shelf Support Brace  Bottom Shelf Support Brace (not shown)  Ledge Shelf  Sloping Shelf Support (not shown)	5094 5110 5111 5130 5132 5133 5134 5135 5141 5152



COMPONENT IDENTIFIER The most frequently used ERECTOMATIC parts for standard shelving are identified as to nomenclature, location in an assembled model, and part number. See pages 28 through 32 for complete part descriptions and dimensional data.





Key	Description	Part No.	Key	Description	Part No.
21 22 23 24 25 26 27 28 29	Counter Top End Cap Bin Front Base Strip Full Divider Partial Divider Sliding Doors (not shown) Swinging Doors Universal Clip (not shown)	5195 5201 5220 5232 5240 5250 5290 5300 5315	32 33 34 35 36 37 38 39 40	Side Sway Brace Label Holder Finished End Panel Filler Panel Sloping Shelf Insert (not shown) Milling Cutter Insert (not shown) Milling Cutter Panel & Hooks (not shown) Shelf Box Shelf Box Divider	5344 5370 5392 5395 5408 5411 5412-5415 5500 5550
30 31	Back Sway Brace Widespan Back Sway Braces	5340 5342	41 42	Widespan Shelves Widespan Base Strip	5700 5706



	Dimensions	Dont Number	
Width	Depth	Height	Part Number

1. DRAWER INSERTS. For small parts storage. Completely enclosed, all-welded case construction; embossed for stacking. Units are 33-3/4" wide x 10-1/2" high, in depths of 11-1/4" and 17-1/4". Each drawer has an integral label holder and two adjustable dividers. Drawers are interchangeable and can be stacked for transporting to job site.

8" 8"	11" 17"	2-5/8" 2-5/8"	1111-12 1117-12
5-1/4"	11"	2-5/8"	1111-18
5-1/4"	17"	2-5/8"	1117-18
5-1/4"	11"	1-3/4"	1111-24
5-1/4"	17"	1-3/4"	1117-24
4"	11"	1-3/4"	1111-32
4"	17"	1-3/4"	1117-32

For additional drawer models including improved designs, see Storage Wall Section, page 98.

2. BEADED FRONT POSTS. True flush construction. Slotted on 1-1/2" centers to permit easy shelf adjustment.

11/16"	2-9/16"	3'3"	5002-3
11/16"	2-9/16"	6'3"	5002-6
11/16"	2-9/16"	7'3"	5002-7
11/16"	2-9/16"	8'3"	5002-8
11/16"	2-9/16"	10'3"	5002-10

3. BACK POSTS. Angled for bracing and slotted on 1-1/2" centers to permit easy shelf adjustment.

1-3/16"	2-5/16"	3'3"	5004-3	
1-3/16"	2-5/16"	6'3"	5004-6	
1-3/16"	2-5/16"	7'3"	5004-7	
1-3/16"	2-5/16"	8'3"	5004-8	
1-3/16"	2-5/16"	10'3"	5004-10	

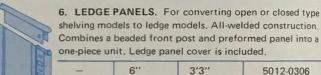
 T-POSTS. Constructed by spotwelding two back posts together. For use when adjoining models are added to form a continuous shelving row.

2-3/8"	2-5/16"	3'3"	5006-3
2-3/8"	2-5/16"	6'3"	5006-6
2-3/8"	2-5/16"	7'3"	5006-7
2-3/8"	2-5/16"	8'3"	5006-8
2-3/8"	2-5/16"	10'3"	5006-10

5. POST SPLICE CHANNEL. A channel formed internal splice. Used to splice beeded front posts for added height. Also, to splice back posts and T-posts.

-0.0	-	-	5009

Dimensions Part Number
Width Depth Height



12"

7. FOOT PLATES. 1/8" thick with mounting bracket
welded to top for bolting to post. Has 7/16" dia. hole
for floor anchor bolts. Use same shim as H-Post (see
page 45). Use where anchoring is needed, where shim-
mering for leveling is required, or where greater post-
load distribution is desired to minimize damage to floor
or floor covering. Attach to front and rear posts.

3'3"

5012-0312

2-1/4	3-1/2"	-	5050

8. COUNTER FRONTS. Give a finished appearance to counter models. Tops are flanged and pierced at vertical edges on 1" centers.

36"	_	3'3"	5070-3603
00		33	5070-3603

9. SHELF REINFORCING CHANNELS. 12 gauge, 1" x 1-1/8" x 5/16" formed channels. Used across the width, on the underside of a shelf, for added load capacity on shelf Classes 1, 2, and 3.

			the state of the s
36"	-	_	5082-36
42"	-	-	5082-42
48''	-	_	5082-48

10. END PANELS. All-welded sections consisting of beaded front post, back post, and one-piece side panel. For individual models or starting and ending models in a continuous shelving row.

	cindous shelving	row.	
-	12"	3'3"	5092-1203
-	12"	6'3"	5092-1206
-	12"	7'3"	5092-1207
-	12"	8'3"	5092-1208
	12"	10'3"	5092-1210
	15"	7'3"	5092-1507
一 一	18"	3'3"	5092-1803
- 18	18"	6'3"	5092-1806
- 101 -	18"	7'3"	5092-1807
-	18"	8'3"	5092-1808
	18"	10'3"	5092-1810
-	24"	3'3"	5092-2403
-	24"	6'3"	5092-2406
-	24"	7'3"	5092-2407
-	24"	8'3"	5092-2408
	24"	10'3"	5092-2410
	30"	7'3"	5092-3007
	36"	7'3"	5092-3607



Dimensions
Width Depth Height Part Number

11. T-PANELS. All welded sections consisting of a beaded front post, T-post, and one-piece side panel. For use when adjoining models are added to form a continuous shelving row.

-	12"	3'3"	5094-1203
-	12"	6'3"	5094-1206
-	12"	7'3"	5094-1207
-	12"	8'3"	5094-1208
-	12"	10'3"	5094-1210
-	15"	7'3"	5094-1507
-	18"	3'3"	5094-1803
-	18"	6'3"	5094-1806
-	18"	7'3"	5094-1807
-	18"	8'3"	5094-1808
-	18"	10'3"	5094-1810
-	24"	3'3"	5094-2403
-	24"	6'3"	5094-2406
	24"	7'3"	5094-2407
-	24"	8'3"	5094-2408
-	24"	10'3"	5094-2410
-	30"	7'3"	5094-3007
-	36"	7'3"	5094-3607



12. BACK PANELS. One-piece sections. Pierced on 1" centers at vortical edges and center for attaching to back posts and shelves.

The second secon		THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	NAME AND ADDRESS OF TAXABLE PARTY.
36"	-	3'3"	5110-3603
36"	-	4'3"	5110-3604
36"	-	6'3"	5110-3606
36"	-	7'3"	5110-3607
42"	-	7'3"	5110-4207
48"		7'3"	5110-4807



13.BACK PANEL CLIPS. Spring steel. Formed to fit bottom flange of standard shelf and tabbed to pick up holes in center of back panel section. Holds back panel to shalf and prevents panel howing.

to shelf and	prevents p	panel bowing.	
-	-	-	5111

Dimensions			
Width	Depth	Height	Part Number

14. SHELVES (Class 0). 18 gauge cold-rolled steel. Front and rear edges have triple formed flanges with box flanges on sides. All corners are lapped and welded for maximum strength. Top pierced on 1" centers for adjustment of dividers. Shelves 24" and deeper also have center piercing. Can be easily reinforced for additional load capacity.

36"	12"	-	5130-3612
36"	15"	-	5130-3615
36"	18"	-	5130-3618
36"	24"	-	5130-3624
 36"	30"	-	5130-3630
36"	36"	_	5130-3636
42"	12"	_	5130-4212
42"	18"	_	5130-4218
42"	24"	- /	5130-4224
42"	30"	-	5130-4230
42"	36"	_	5130-4236
48"	12"	_	5130-4812
48"	18"	_	5130-4818
48"	24"	_	5130-4824
48"	30"	-	5130-4830
48"	36"	-	5130-4836

15. SHELF SUPPORTS. Provide full depth shelf support.

Built-in locking device at each end. Furnished in pairs.

-	12"	-	5132-12
-	18"	-	5132-18
-	24"	_	5132-24



16. SHELF CLIPS. One-piece, zinc plated compression clips. Fit snugly against side of posts to hold shelves in place. For use with standard and widespan shelves. 4 required per shelf.

-	-	_	5133

17. SHELF SUPPORT BRACES. Used to support center reinforcing channels except on bottom shelf in Class 3 applications.

-	18"	-	5134-18
-	24"	-	5134-24



18. BOTTOM SHELF SUPPORT BRACES. Used only on Class 3 bottom shelves to support center reinforcing channels. Positioned in center of shelf; rests on floor.

-	_	-	5135

19. LEDGE SHELVES. Smooth surfaced top and front flange. All welded corners. Similar construction to standard shelves. Shelf supports should be ordered separately depending on depth of model above the ledge.

36"	18"	-	5141-3618
36"	24"	-	5141-3624



Dimensions
Width Depth Height

20. SLOPING SHELF SUPPORTS. Support full depth of shelf inverted in a shelving model. Shelf rises 1" for every 3" in depth. Takes a standard shelf (Part No. 5130), pierced on 1" centers for adjustment of dividers. Use partial dividers (Part No. 5250).

-	12"	-	5152-12
-	18"	-	5152-18
-	24"	-	5152-24

21. COUNTER TOPS. Heavy duty steel working surface with cornice at front and rear. Use end caps (Part No. 5201) for finishing cornice on ends.

36"	18"	-	5195-3618
36"	24"	_	5195-3624

22. END CAPS. Provide a finished cornice on extreme ends of counter top applications. Furnished in pairs.

-	18"	-	5201-18
-	24"	-	5201-24

23. BIN FRONTS. Offset type with bead at top and triple flange at bottom to telescope over shelf flange.

36"	-	1"	5220-3601
36"	-	3"	5220-3603
42"	-	3"	5220-4203
48"	_	3"	5220-4803

24. BASE STRIPS. Shaped to fit directly between bottom shelf and floor. 2-15/16" high, giving an overall base height, including bottom shelf of 3".

36"	-	2-15/16"	5232-36
42"	-	2-15/16"	5232-42
48"	-	2-15/16"	5232-48

25. FULL DIVIDERS. Front edge beaded; top, bottom, and rear edges are flanged. When 18" deep or more, top edge is notched for Class 3 reinforcing channels.

-	12"	6"	5240-1206
	12"	9"	5240-1209
	12"	12"	5240-1212
	18"	6"	5240-1806
	18"	9"	5240-1809
	18"	12"	5240-1812
-	24"	6"	5240-2406
	24"	9"	5240-2409
	24"	12"	5240-2412

Dimensions
Width Depth Height

Part Number

26. PARTIAL DIVIDERS. Partition straight or sloping shelves from front to rear. Flanged and pierced for shelf attachment, with rounded top corners for safety.

_	12" 12"	2" 4"	5250-1202 5250-1204
	18"	2":	5250-1802
_	18"	4"	5250-1804
_	24"	2"	5250-2402
_	24"	4"	5250-2404

27. SLIDING DOORS (with locks). Flanged on all four sides and reinforced. Grooved key cylinder lock included. Doors slide on quiet, smooth-running nylon rollers and guides. Complete with mounting channels (top and bottom). Mounting brackets included. Designed for use on single models with standard shelf at top. Universal clips (Part No. 5315) are required to mount doors and must be ordered separately.

72"	-	36"	5290-7236
72"	-	84"	5290-7284



28. SWINGING DOORS (with locks). Pan-reinforced doors attach to an all-welded channel frame and open quietly to a full 150°. Chrome finished handle with built-in grooved key cylinder lock. Positive 3-point locking (top, bottom, center). Universal clips (Part No. 5315) are required to mount doors on beaded front posts.

	1		
36''	-	36"	5300-3636
36"	-	48"	5300-3648
36"	-	84"	5300-3684
48"	_	36"	5300-4836
48''	-	84"	5300-4884



29. UNIVERSAL CLIP (with hardware). Available in sets. One set required to mount swinging doors to beaded front posts; two sets required for sliding doors.

-	5315

30. BACK SWAY BRACES (standard shelves). 11 gauge 1" x 1/8" steel strip with safety edges. One pair of braces are bolted together at center to form an "X". Ends are radiused and pierced for mounting to rear post. See Technical Section, page 6, for bracing information.

-	36"	-	5342-38
-	42"	-	5342-44
_	48"	-	5342-55



Dimensions		Part Number	
Width	Depth	Height Part N	Part Number

31. BACK SWAY BRACES (widespan shelves). Set of four 11 gauge, 1" x 1/8" steel strip braces mounted to a 14 gauge tensioning disc. Disc rotates to pretension braces for maximum stability. Brace ends are radiused and pierced for mounting to rear post. See Technical Section, page 6, for bracing information. (Pat. Pend.)

72"	-	-	5343-72
84"	-	_	5343-84
96"	-	-	5343-96

32. SIDE SWAY BRACES. 11 gauge, 1"  $\times$  1/8" steel strip with safety edges. One pair of braces are bolted together at the center to form an "X". Ends are radiused and pierced for attaching to front and rear posts in the side position. See Technical Section, page 6, for bracing information.

_	12"	-	5344-12
_	15"	-	5344-15
_	18"	-	5344-18
_	24"	-	5344-24
_	30"	_	5344-30
_	36"	-	5344-36

**33. LABEL HOLDERS.** Pierced for attaching to front flange of shelves with top and bottom edges folded over to accommodate labels approximately 1" high.

	36"	_	5370-3601
_	42"	_	5370-4201
_	48"	-	5370-4801

34. FINISHED END PANELS. Provide clean, smooth, finished appearance to shelving row ends. Strong and sturdy.

-	12"	3'3"	5392-1203
_	12"	6'3"	5392-1206
_	12"	7'3"	5392-1207
_	12"	8'3"	5392-1208
-	12"	10'3"	5392-1210
-	15"	7'3"	5392-1507
_	18"	3'3"	5392-1803
-	18"	6'3"	5392-1806
_	18"	7'3"	5392-1807
	18"	8'3"	5392-1808
_	18"	10'3"	5392-1810
	24"	3'3"	5392-2403
	24"	6'3"	5392-2406
	24"	7'3"	5392-2407
	24"	8'3"	5392-2408
-	24"	10'3"	5392-2410
-	30"	7′3″	5392-3007
-	36"	7'3"	5392-3607
	The same of the sa		

	Dimensions			
	Width	Depth	Height	Part Number
~	35. FILLER	PANELS FOR	R STORAGE V	WALLS, Fully

35. FILLER PANELS FOR STORAGE WALLS. Fully enclose a 36" shelf opening when storage wall inserts are used in the opening. Provide a neat, finished appearance to the storage model.

-	-	-	5395
---	---	---	------

36. SLOPING SHELF INSERTS. 108 sloping compartments varying in depth from 8-1/2" to 17" make these models ideal for storing drills, reamers, taps, etc. Lower three shelves have 11 compartments, each 3" wide x 1" high; upper five shelves have 15 compartments, each 2-1/4" wide x 1" high. Compartment width is not adjustable. Shipped assembled as shown, ready to use, with full width label holders.

33-5/8"	17"	34-1/2"	5408
---------	-----	---------	------

37. MILLING CUTTER INSERTS. For 36" wide standard shelving. Back panel and two double-wall doors are punched for the attachment of pegs for the systematic storage of milling cutters. Doors are 17-3/8" wide x 33-5/8" high with lever lock attached.

33-3/4"	33-3/8"		5411
33-3/4	33-3/0	1000	2411



**38. MILLING CUTTER PANELS AND HOOKS.** For mounting on outside of standard shelving or rack ends, Panel is 17-3/8" wide x 33-3/8" high, and is designed for shelving 18" deep. Panel is punched for attachment of pegs.

17-3/8"	-	33-3/8"	5412 Back Panel
			5413 End Panel
			5414 Peg Hook
			5415 Check Hook

39. SHELF BOXES. Drawer front has integral full finger grip and embossed label holder. Slotted on 1" centers for positioning of dividers. Dividers not included. Built-in back stop prevents accidental removal of drawer.

5-7/8" 5-7/8"	11-3/4" 17-3/4" 23-3/4"	4-5/8" 4-5/8" 4-5/8"	5500-6412 5500-6418 5500-6424	
8-3/4"	11-3/4"	4-5/8"	5500-6424	
8-3/4" 8-3/4"	17-3/4" 23-3/4"	4-5/8" 4-5/8"	5500-9418 5500-9424	
11-5/8" 11-5/8" 11-5/8"	11-3/4" 17-3/4" 23-3/4"	4-5/8" 4-5/8" 4-5/8"	5500-12412 5500-12418 5500-12424	

40. SHELF BOX DIVIDERS. For quick and easy partitioning of shelf boxes on 1" centers.

- - - 5550-64
- - 5550-94
- - 5550-124



	Dimensions		
Width	Depth	Height	Part Number

### 41. WIDESPAN SHELVES (U.S. Patent No.

3,556,309). For open shelf spans of 72", 84", and 96". Tubular flanged I-beam design with two I-beams running the entire width of the shelf to provide strength and rigidity. 18" and 24" deep shelves have a Z-shaped reinforcing bar located in the middle under the shelf top. 30" and 36" deep shelves have two such reinforcing bars, located equidistantly offcenter beneath the shelf top. Shelf reinforcements are spot welded on 6" centers across the full shelf width. End channels are also welded.

	72"	18"	-	5700-7218
my	72"	24"	-	5700-7224
III)	72"	30''	-	5700-7230
	72"	36"	_	5700-7236
	84"	18"	-	5700-8418
	84"	24"	-	5700-8424
	84"	30"	-	5700-8430
	84"	36"	-	5700-8436
	96"	18"	-	5700-9618
	96"	24"	-	5700-9624
	96"	30"	-	5700-9630
	96"	36"	-	5700-9636



42. WIDESPAN BASE STRIPS. Fit between bottom shelf and floor on widespan shelving to give neat, finished appearance to unit.

72"	-	-	5706-72
84"	-	-	5706-84
96"	-	-	5706-96

## DOCUMENT STORAG

12"

15"

shelf file dividers. 36"

36"

OCUMENT STORAGE COMPONENTS							
		Dimensions					
	Width	Depth	Height	Part Number			
1	OPEN SHELF FILE DIVIDERS. For shelves on 12" centers, 12" and 15" depths to take standard height file folders. 3-point positive positioning. Fits standard shelf divider holes. Top rear section slides into divider support bracket slots. Easily repositioned on 1" centers. Flat and smooth. No obstruction to cause wear and tear on file folders.						
7	-	12" 15"	12" 12"	5585-12 5585-15			
bolt and not for attachment to center hole on rear fl shelf. Adjustable on 1" centers. When used below re shelf, can be bolted to rear posts and center of back							
	36"	-	-	5586-36			
	EXTENDED BASE. Protects stored file folders from possible wear and tear caused by floor traffic. Enhances appearance of the storage unit.						
1	36"	-	_	5587-36			
	FINISHED END PANELS. Provide a neat, clean, finished appearance by enclosing row ends. In painted months of the control of the						

appearance by enclosing row ends. In painted metal. Selfedged plastic over particle board available upon request.

SLIDING REFERENCE SHELF. Provides a work surface that can be pulled out to hold a file folder for reference

or to hold a stack of folders for refiling. Bolts to standard

shelf through divider holes. Vertical opening below refer-

ence shelf must be 15" to allow for use of standard open

12"

15"

7'3"

7'3"

5588-12

5588-15

5589-12

5589-15

Fixed or nut and bolt shelving Economical. Provides maximum rigidity and stability. Optimum strength makes it ideal for heavy duty applications. Models are 7'3" high, 36" wide, in the shelf depths shown. Shelves are Class 0 and can be easily reinforced for additional capacity. (See page 4.)



### **ERECTOMATIC FIXED SHELVING**



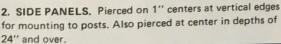
Shelf	MODEL 5580	MODEL 5581
Depth	Starting	Starting
12"	5580-12	5581-12
18"	5580-18	5581-18
24"	5580-24	5581-24
30"	5580-30	5581-30
36"	5580-36	5581-36
	Adjoining	Adjoining
12"	A-5580-12	A-5581-12
18"	A-5580-18	A-5581-18
24"	A-5580-24	A-5581-24
30"	A-5580-30	A-5581-30
36"	A-5580-36	A-5581-36

NOTE: The following standard components may also be used with Hallowell fixed shelving. See pages 28 to 31 for complete parts descriptions.				
Part No.	Description			
5070	Counter Fronts			
5082	Shelf Reinforcing Channels			
5110	Back Panels			
5130	Standard Shelves			
5232	Base Strips			
5240	Full Dividers			
5250	Partial Dividers			
5300	Swinging Doors			
5342	Back Sway Braces			
5370	Label Holders			

NOTE: Other sizes available: 42" and 48" widths, 3'3", 6'3", 8'3" and 10'3" heights.

### FIXED SHELVING COMPONENTS

		Dimensions			
	Width	Depth	Height	Part Number	
111	1. POSTS. St	eel Angles, 1	3 gauge x 1"	x 1-3/4". Pierced of	
	1" centers for	adjustment		using nuts and bolts	
	Water to	-	3′3″ 6′3″	5000-0003-13	
		_			
		_	7'3"	5000-0007-13	
	_	_	7′3″ 8′3″	5000-0007-13 5000-0008-13 5000-0010-13	



-	12"	3'3"	5090-1203
	12"	6'3"	5090-1206
	12"	7'3"	5090-1207
_	15"	7′3′′	5090-1507
	18"	3'3"	5090-1803
	18"	6'3"	5090-1806
	18"	7'3"	5090-1807
-	24"	3'3"	5090-2403
	24"	6'3"	5090-2406
	24"	7'3"	5090-2407
-	30"	7′3″ 7′3″	5090-3007 5090-3607

3. COUNTER TOPS. Heavy duty steel working surface with cornice at front and rear.

36"	18" 24"	-	5196-3618 5196-3624
36''	24		

 END CAPS. Provide a finished cornice on extreme ends of counter top applications.

-			F202 10
	18"	-	5202-18
-	10		5202-24
-	24"	-	3202 2
	2.		

		Dimensions		
	Width	Depth	Height	Part Number
X		Mount to posts.	sides of op	
	-	12", 15", 18", 24", 30", 36"		5342-38 5342-44

6. ANGLE SWAY BRACES. Pierced for bolting to shelf and post for rigidity.

- - 5350

7. SHELF BOXES. Three piece spotwelded construction (body and 2-sides). Full width handle and flush embossed label holder in front; a safety stop at rear. Sides are safety edged along top and double slotted and ribbed for dividers on 1" centers. Partial dividers used as box guides.





8. SHELF BOX DIVIDERS. For quick and easy partitioning of shelf boxes on 1" centers.

-	-	-	5575-54
-	-	-	5575-84
-	-	-	5575-114

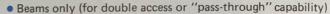


A UNIQUE STORAGE CAPABILITY FOR BULKY, HIGH

DENSITY LOADS Used where storage and order picking require the handling of a wide variety of products in a wide variety of shapes, sizes, and bulk--from table lamps to stacks of wallboard, from coils of wire to bolts of material, from trash cans to waste buckets, from over sized cartons to standard cases. The list is endless and covers virtually any hand loaded, unpalletized item, regardless of how awkward, bulky or cumbersome it may be.

### **ERECTOMATIC High Density Shelving with**

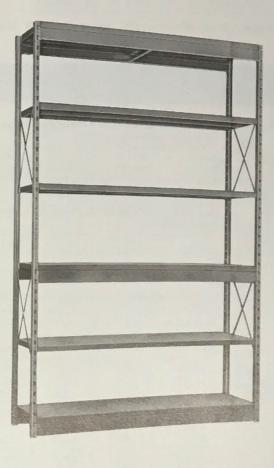
H-Posts provides maximum effective shelf area over a widespan, maximum load capacity per shelf, and maximum stored product density per cube. Basic models are 7'3", 8'3", and 10'3" high, with shelf widths to 96" and shelf depths from 18" to 36". The following high density shelf combinations are available:



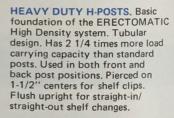
- Combination Beams and Widespan Shelves (Open and Closed)
- Widespan Shelves Only (Open and Closed)
- Combination Widespan and Standard Shelves
- Standard Shelves (Open and Closed)

All models can be expanded to multi-level or high rise storage systems whenever the needs warrant. Refer to technical section, pages 4 and 5, for shelf loading information.

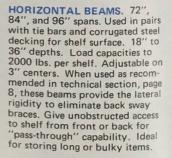
Here are the elements which make ERECTOMATIC High Density Shelving so versatile.







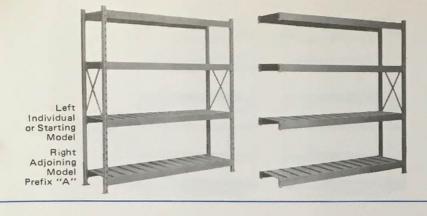






ERECTOMATIC WIDESPAN SHELVES. 72", 84", and 96" widths; 18" to 36" depths. Load capacities to 1500 lbs. per shelf. Adjustable on 1-1/2" centers. Require back sway braces except when used with horizontal beams which provide the lateral rigidity needed for "pass-through" applications

ERECTOMATIC STANDARD SHELVES (not shown). Can also be used with H-Posts in a high density system. 36", 42", and 48" widths; 12" to 36" depths. Load capacities to 700 lbs. per shelf for Class 0; to 2000 lbs. when shelves are reinforced to Class 3.





# OPEN MODELS WITH CORRUGATED STEEL DECKING





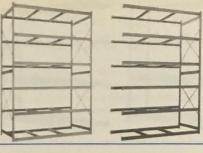


		MODEL 5601	MODEL 5602	MODEL 5603
She	olf	7'3'' high 4 beam levels*	8'3" high 5 beam levels*	10'3" high 6 beam levels*
Width	Depth	Starting	Starting	Starting
72''	18" 24" 30"	5601-7218-7 5601-7224-7 5601-7230-7 5601-7236-7	5602-7218-8 5602-7224-8 5602-7230-8 5602-7236-8	5603-7218-10 5603-7224-10 5603-7230-10 5603-7236-10
84"	36" 18" 24" 30"	5601-8418-7 5601-8424-7 5601-8430-7 5601-8436-7	5602-8418-8 5602-8424-8 5602-8430-8 5602-8436-8	5603-8418-10 5603-8424-10 5603-8430-10 5603-8436-10
96"	36" 18" 24" 30" 36"	5601-9430-7 5601-9618-7 5601-9624-7 5601-9630-7 5601-9636-7	5602-9618-8 5602-9624-8 5602-9630-8 5602-9636-8	5603-9618-10 5603-9624-10 5603-9630-10 5603-9636-10
	30	Adjoining	Adjoining	Adjoining
72''	18" 24" 30"	A-5601-7218-7 A-5601-7224-7 A-5601-7230-7 A-5601-7236-7	A-5602-7218-8 A-5602-7224-8 A-5602-7230-8 A-5602-7236-8	A-5603-7218-10 A-5603-7224-10 A-5603-7230-10 A-5603-7236-10
84"	36" 18" 24" 30"	A-5601-8418-7 A-5601-8424-7 A-5601-8430-7 A-5601-8436-7	A-5602-8418-8 A-5602-8424-8 A-5602-8430-8 A-5602-8436-8	A-5603-8418-10 A-5603-8424-10 A-5603-8430-10 A-5603-8436-10
96"	36" 18" 24" 30" 36"	A-5601-9618-7 A-5601-9624-7 A-5601-9630-7 A-5601-9636-7	A-5602-9618-8 A-5602-9624-8 A-5602-9630-8 A-5602-9636-8	A-5603-9618-10 A-5603-9624-10 A-5603-9630-10 A-5603-9636-10

NOTES: 1, 72" wide models have one tie bar per pair of beams; 84" and 96" wide models, two tie bars per pair of beams.

- 2. Refer to technical section, page 5, for beam load information.
- 3. See page 44 for component parts.
- \*4. One pair of beams per level provides lateral support.





Left Individual or Starting Model

Bight Adjoining Model Prefix "A"

**Actual Size** 

(in.)

95½ x 16¼ 95½ × 22¼ 95½ × 28¼

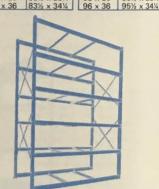
**OPEN MODELS WITHOUT CORRUGATED** STEEL DECKING For use with plywood or composition board decking (available from local sources).

TABLE VI. Plywood or Composition Board Decking

Nom. Size (in.)	Actual Size (in.)	Nom. Size (in.)	Actual Size (in.)	Nom. Size
72 x 18	71½ × 16¼	84 x 30	83½ x 16¼	96 x 18
72 x 24	71½ × 22¼		83½ x 22¼	96 x 24
72 x 30	71½ × 28¼		83½ x 28¼	96 x 30
72 x 36	71½ × 34¼		83½ x 34¼	96 x 36







_	The same of			
		MODEL 5604	MODEL 5605	MODEL 5606
Shelf		7'3" high 4 beam levels"	8'3" high 5 beam levels*	10'3" high 6 beam levels*
Width	Depth	Starting	Starting	Starting
72"	18" 24" 30" 36"	5604-7218-7 5604-7224-7 5604-7230-7 5604-7236-7	5604-7218-8 5605-7224-8 5605-7230-8 5605-7236-8	5606-7218-10 5606-7224-10 5606-7230-10 5606-7236-10
84"	18" 24" 30" 36"	5604-8418-7 5604-8424-7 5604-8430-7 5604-8436-7	5605-8418-8 5605-8424-8 5605-8430-8 5605-8436-8	5606-8418-10 5606-8424-10 5606-8430-10
96"	18" 24" 30" 36"	5604-9618-7 5604-9624-7 5604-9630-7 5604-9636-7	5605-9618-8 5605-9624-8 5605-9630-8 5605-9636-8	5606-8436-10 5606-9618-10 5606-9624-10 5606-9630-10
		Adjoining	Adjoining	5606-9636-10 Adjoining
72"	18" 24" 30" 36"	A-5604-7218-7 A-5604-7224-7 A-5604-7230-7 A-5604-7236-7	A-5605-7218-8 A-5605-7224-8 A-5605-7230-8 A-5605-7236-8	A-5606-7218-10 A-5606-7224-10 A-5605-7230-10
84"	18" 24" 30" 36"	A-5604-8418-7 A-5604-8424-7 A-5604-8430-7 A-5604-8436-7	A-5605-8418-8 A-5605-8424-8 A-5605-8430-8 A-5605-8436-8	A-5606-7236-10 A-5606-8418-10 A-5606-8424-10 A-5606-8430-10
96"	18" 24" 30" 36"	A-5604-9618-7 A-5604-9624-7 A-5604-9630-7 A-5604-9636-7 ide models have one tie bar per pair of	A-5605-9618-8 A-5605-9624-8 A-5605-9630-8 A-5605-9636-8	A-5606-8436-10 A-5606-9618-10 A-5606-9624-10 A-5606-9630-10 A-5606-9636-10

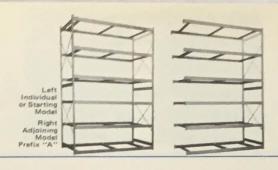
- 72" wide models have one tie bar per pair of beams; 84' and 96" wide models, two tie bars per pair of beams. Additional tie bars (Part No. 5030) may be installed to give support and limit deflection of plywood or com
  - position board decking.

    2. Plywood and composition board are manufactured in
- nominal sheet sizes. Consult Table VI above to determine actual size of decking to be installed.

  3. Refer to technical section, page 5 for beam load information.

  4. See page 44 for component parts.

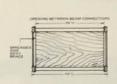
  5. One pair of beams per level provides lateral support.

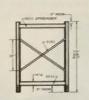


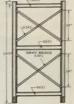


OPEN MODELS WITHOUT CORRUGATED STEEL DECKING For use with standard 48" x 96" plywood or composition board decking (available from local sources).

### TABLE VII. Typical Knockdown Frame Assemblies













	MODEL 5607 MODEL 5608		MODEL 5609	
aut	7'3" high	8'3" high 5 beam levels*	10'3" high 6 beam levels*	
1	Starting		Starting	
48"	5607-9648-7	5608-9648-8	5609-9648-10	
	Adjoining	Adjoining	Adjoining	
48"	7007.0040.7	A-5609-9648-8	A-5609-9648-10	
		Depth Starting  48" 5607-9648-7  Adjoining	## ## ## ## ## ## ## ## ## ## ## ## ##	

- NOTES: 1. Models are supplied with three tie bars per pair of beams. Additional tie bars (Part No. 5030) may be installed to give support and limit deflection of plywood or composition board decking.
- Typical frame assemblies are shown above. Refer to technical section, page 5, for beam load information.
- 3. See pages 44 for component parts.
- \*4. One pair of beams per level provides lateral support.







Left Individual or Starting Model

Right Adjoining Model Prefix "A"

#### **OPEN MODELS WITH BEAMS AND WIDESPAN**

SHELVES Provide "pass-through" capability with unobstructed double access to shelves from either front or back. Models are 72", 84", and 96" wide in the heights and depths shown.







	Contract of the last of the la	THE RESIDENCE OF THE PARTY OF T		
		MODEL 5620	MODEL 5621	MODEL 5622
Sh	nelf	7'3" high 2 beam levels* 4 shelves	8'3'' high 2 beam levels* 5 shelves	10'3" high 3 beam levels* 6 shelves
Width	Depth	Starting	Starting	Starting
72"	18" 24" 30" 36"	5620-7218-7 5620-7224-7 5620-7230-7 5620-7236-7	5621-7218-8 5621-7224-8 5621-7230-8 5621-7236-8	5622-7218-10 5622-7224-10 5622-7230-10 5622-7236-10
84"	18" 24" 30" 36"	5620-8418-7 5620-8424-7 5620-8430-7 5620-8436-7	5621-8418-8 5621-8424-8 5621-8430-8 5621-8436-8	5622-8438-10 5622-8424-10 5622-8430-10 5622-8436-10
96"	18" 24" 30" 36"	5620-9618-7 5620-9624-7 5620-9630-7 5620-9636-7	5621-9618-8 5621-9624-8 5621-9630-8 5621-9636-8	5622-9618-10 5622-9624-10 5622-9630-10 5622-9636-10
	1011	Adjoining	Adjoining	Adjoining
72"	18" 24" 30" 36"	A-5620-7218-7 A-5620-7224-7 A-5620-7230-7 A-5620-7236-7	A-5621-7218-8 A-5621-7224-8 A-5621-7230-8 A-5621-7236-8	A-5622-7218-10 A-5622-7224-10 A-5622-7230-10
84"	18" 24" 30" 36"	A-5620-8418-7 A-5620-8424-7 A-5620-8430-7 A-5620-8436-7	A-5621-8418-8 A-5621-8424-8 A-5621-8430-8 A-5621-8436-8	A-5622-7236-10 A-5622-8418-10 A-5622-8424-10 A-5622-8430-10
96"	18" 24" 30" 36"	A-5620-9618-7 A-5620-9624-7 A-5620-9630-7 A-5620-9636-7	A-5621-9618-8 A-5621-9624-8 A-5621-9630-8 A-5621-9630-8	A-5622-8436-10 A-5622-9618-10 A-5622-9624-10 A-5622-9630-10 A-5622-9630-10

- NOTES: 1, 7'3" and 8'3" adjoining models are supplied with one pair of beams; 10'3" adjoining models, with two pair of beams, For ending models in a continuous shelving row, add one additional pair of beams (Part No. 5029).
  - 2. Refer to technical section, page 8 for details on proper location of beams in a continuous shelving row.
  - 3. See page 44 for component parts.
    - \*4. One pair of beams per level provides lateral support.





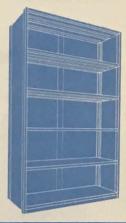


### CLOSED MODELS WITH WIDESPAN SHELVES

Models are 72", 84", and 96" wide in the heights and depths shown.







	MODEL 5630	MODEL 5631	MODEL 5632
elf	7'3" high 4 shelves	8'3" high 5 shelves	10'3" high 6 shelves
Depth	Starting	Starting	Starting
18" 24" 30" 36"	5630-7218-7 5630-7224-7 —	5631-7218-8 5631-7224-8 — —	
18" 5630-8418-7 5630-8424-7 30"		5631-8418-8 5631-8424-8 —	5632-8430-10 5632-8436-10
18" 24" 30"	5630-9618-7 5630-9624-7 —	5631-9618-8 5631-9624-8 — —	
	Adjoining	Adjoining	Adjoining
18" 24" 30"	A-5630-7218-7 A-5630-7224-7	A-5631-7218-8 A-5631-7224-8 —	A-5632-7230-10 A-5632-7236-10
18" 24" 30"	A-5630-8418-7 A-5630-8424-7	A-5631-8418-8 A-5631-8424-8 —	- A-5632-8430-10 A-5632-8436-10
36" 18" 24" 30"	A-5630-9618-7 A-5630-9624-7	A-5631-9618-8 A-5631-9624-8 —	
	Depth  18" 24" 30" 36" 18" 24" 30" 36" 18" 24" 30" 36" 18" 24" 30" 36" 18" 24" 30" 36"	Total Content	Total Content

NOTES: 1. For 8'3" and 10'3" models, different heights of back panels (Part No. 5110)

2. Back to back models have common

clips for attachment to rear posts. When ordering, specify "less back panels and connector are combined to achieve model heights, strips" for one common model; add combination 10'3" high-9 combination clips per rear post. clips (Part No. 5027) according to model height 3, See page 44 for component parts.

7'3" high- 7 combination clips per rear post 8'3" high-8 combination clips per rear post







Left Individual or Starting Model

Right Adjoining Model Prefix "A"

#### **OPEN MODELS WITH WIDESPAN SHELVES**

Models are 72", 84", and 96" wide in the heights and depths shown.







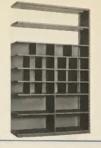
		The state of the s		
		MODEL 5640	MODEL 5641	MODEL 5642
Shelf		7'3" high 4 shelves	8'3" high 5 shelves	10'3" high 6 shelves
Nidth		Starting	Starting	Charles
72"	18" 24" 30" 36"	5640-7218-7 5640-7224-7 —	5641-7218-8 5641-7224-8	Starting
84"	18" 24" 30" 36"	5640-8418-7 5640-8424-7 —	5641-8418-8 5641-8424-8	5642-7236-10 - 5642-8430-10
96"	18" 24" 30" 36"	5640-9618-7 5640-9624-7 - -	5641-9618-8 5641-9624-8	5642-8436-10 
		Adjoining	Adjoining	5642-9636-10
72"	18" 24" 30" 36"	A-5640-7218-7 A-5640-7224-7	A-5641-7218-8 A-5641-7224-8	Adjoining
84"	18" 24" 30" 36"	A-5640-8418-7 A-5640-8424-7 —	A-5641-8418-8 A-5641-8424-8	A-5642-7236-10 
96"	18" 24" 30" 36"	A-5640-9618-7 A-5640-9624-7	A-5641-9618-8 A-5641-9624-8	A-5642-8436-10 

 Back to back models have common back sway braces and require use of combination clips for attachment to rear posts. When ordering, specify "less back sway braces" for one common model; add combination clips (Part No. 5027) on the basis of two per rear post per pair of braces. Order according to model height as follows: 7'3" - 2 combination clips per rear post. 8'3" - 4 combination clips per rear post. 10'3" - 4 combination clips per rear post. Example: 4 models 7'3" high arranged back to back would require 2 pair of

common back away braces and 2 combination clips per rear post for a total of 12 clips, 8'3" or 10'3" his models would require four pair of common back away braces and 4 combination clips per rear post for e total of 24 clips.

Refer to technical section, page 6 for bracing information.
 See page 44 for component parts.





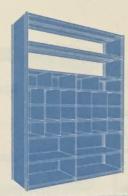


### COMBINATION MODELS WITH STANDARD AND

WIDESPAN SHELVES All models are 10'3" high; 72",

84", or 96" wide in the depths shown. Backs are closed to a 7'3" height in lower sections. 3' upper sections are open. Sides are closed to full 10'3" height at ends and to 7'3" at intermediate panels.





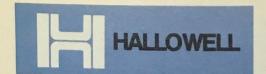


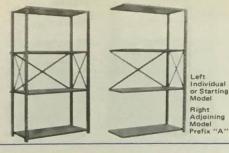
	MOI	MODEL 5650		EL 5651	МО	DEL 5652
Shelf Depth	Openings 2 18 4 4 72" w	Size 72" x 18" 12" x 12" 18" x 12" 36" x 18"	Openings 2 18 4 4 84" wid	Size 84" x 18" 14" x 12" 21" x 12" 42" x 18"	Openings 2 18 4 4 96" w	Size 96" × 18" 16" × 12" 24" × 12" 48" × 18"
	S	Starting		arting	S	tarting
18" 24"		650-18 650-24	(2000)	51-18 51-24		652-18 652-24
	A	Adjoining		oining	Ad	joining
18" 24"		6650-18 6650-24	101.00	651-18 651-24		5652-18 5652-24
				1.0	Defeate	

NOTES: 1. Standard shelves are Class 0 and can be easily reinforced for additional capacity. Refer to

technical section, pages 4 and 5 for load capacity information.

2. Dimensions of openings are expressed in "width" x "height".





### **OPEN MODELS WITH STANDARD SHELVES**

Models are 48" wide in the heights and depths shown. All shelves are Class 3.







	MODEL 5670	MODEL 5671	MODEL 5672
Shelf Depth	7'3" high 4 shelves	8'3" high 5 shelves	10'3" high 6 shelves
	Starting	Starting	Starting
24" 36"	5670-24 5670-36	5671-24 5671-36	5672-24 5672-36
	Adjoining	Adjoining	Adjoining
24" 36"	A-5670-24 A-5670-36	A-5671-24 A-5671-36	A-5672-24 A-5672-36

- NOTES: 1. Models are also available in 36' and 42" widths; 12", 18", and 30" depths.
  - Back to back models have common back sway braces and require use of combination clips for attachment to rear posts, When ordering, specify "less back sway braces" for one

common model; add combination clips (Part No. 5027) on the basis of two per rear post per pair of braces. Order according to model height as follows.

7:3" - 2 combination clips per rear post 8:3" - 4 combination clips per rear post 10'3" - 4 combination clips per rear post Example: 4 models 7:3" high arranged back to back would require 2 pair of common back sway

braces and 2 combination clips per rear post for

- a total of 12 clips, 8'3" or 10'3" high models would require four pair of common back swey braces and 4 combination clips per rear post for a total of 24 clips.

  3. Refer to technical section, page 6 for bracing information.
- 4. See page 44 for component parts.







### CLOSED MODELS WITH STANDARD SHELVES

Models are 48" wide in the heights and depths shown. All shelves are Class 3.







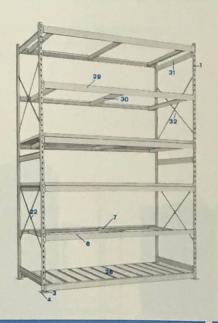
	MODEL 5680	MODEL 5681	MODEL 5682
Shelf Depth	7'3" high	8'3" high	10°3" high
	4 shelves	5 shelves	6 shelves
Sieir Deptir	Starting	Starting	Starting
24"	5680-24	5681-24	5682-24
36"	5680-36	5681-36	5682-36
	Adjoining	Adjoining	Adjoining
24"	A-5680-24	A-5681-24	A-5682-24
	A-5680-36	A-5681-36	A-5682-36

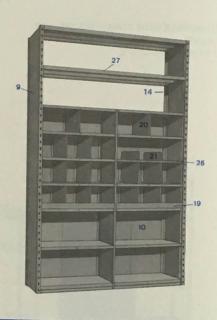
- NOTES: 1. Models are also available in 36" and 42" widths; 12", 18", and 30" depths.
  - 2. For 8'3" and 10'3" models, different heights of back panels (Part No. 5110) and connector strips (Part No. 5113) are combined to achieve model heights.
- 3. Back to back models have common back panels and require the use of combination clips for attachment to rear posts. When ordering, specify "less back panels and connector strips" for one common model; add combination clips (Part No. 5027)
- according to model height as follows: 7'3" high -7 combination clips per post 8'3" high - 8 combination clips per post 10'3" high - 9 combination clips per post
- 4. See page 44 for component parts.



ERECTOMATIC HIGH DENSITY SHELVING COMPONENTS

COMPONENT IDENTIFIER The most frequently used components in ERECTOMATIC High Density Shelving are identified below as to nomenclature, part number, and location in an assembled model. See pages 45 through 47 for complete part descriptions and dimensional data.





Key	Description	Part No.
1	H-Post	5003
2	H-Post Splice*	5009
3	H-Post Foot Plate	5025
4	H-Post Shim Plate	5026
5	Combination Clip	5027
6	Horizontal Beam	5029
7	Beam Tie Bars	5030
8	Standard Shelf Reinforcing Channels*	5082
9	Side Panels	5091
10	Back Panels	5110
11	Back Panel Clip (Standard Shelves)*	5111
12	Back Panel Clip (Widespan Shelves)*	5112
13	Back Panel Connector Strip (Widespan Shelves)*	5113
14	a) Back Panel Connector Strip	5114
	(Standard Shelves-Starting and Ending Models)	
	b) Back Panel Connector Strip*	5115
	(Standard Shelves - Intermediate Models)	
15	Standard Shelf (Class 0)	5130
16	Shelf Clip *Not shown	5133

ey	Description	Part No.
7	Bottom Shelf Support Brace	5135
8	Shelf Support Brace*	5136
9	Bin Front	
0	Full Divider	5220
	Partial Divider	5240
2	Side Sway Brace	5250
3		5341
1	Back Sway Brace (Standard Shelves)*	5342
5	Back Sway Brace (Widespan Shelves)*	5343
6	Label Holder	5370
	Corrugated Steel Decking	5631
7	Widespan Shelf	5700
3	Widespan Base Strip*	5706

### COMPONENTS FOR 48" DEEP MODELS (No. 5607, No. 5608, No. 5609)

29 30 31 32	Horizontal Beam Tie Bars Spreaders Side Sway Braces	5029-PW 5030-48 5031-48
	arac away braces	5341-48



#### **ERECTOMATIC HIGH DENSITY** SHELVING COMPONENTS

Description Part Number Width Depth Height



1. H-POSTS. Tubular design. 14 gauge, 1-1/2" wide x 2-5/16" deep in heights shown. Used in front and rear post positions. Sides slotted on 1-1/2" centers for shelf clips. Fronts slotted on 3" centers for beam connection. Has more than 2 times the load carrying capacity than standard posts.

1-1/2"	2-5/16"	7'3"	5003-7
1-1/2"	2-5/16"	8'3"	5003-8
1-1/2"	2-5/16"	10'3"	5003-10
1-1/2"	2-5/16"	12'3"	5003-12



2. H-POST SPLICE. For use in multi-level and high rise shelving models. Channel shaped to fit inside two connecting H-Posts with a 4-7/8" overlap at top and bottom. Pierced for bolting. Maintains post strength at the splice without interfering with beams, clips, or other accessories.

1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
-	-	9-3/4"	5009



3. H-POST FOOT PLATE. Use where anchoring is needed, where shimming for leveling is required, or where greater post-load distribution is desired to minimize damage to floor or floor covering. 3-1/2" wide x 2-1/4" deep x 1/8" thick with mounting bracket welded to top for bolting inside H-Posts. Base plate has 7/16" diameter hole for floor anchor bolts.

3-1/2"	2-1/4"	1/8"	502



4. H-POST SHIM PLATE. Fits under foot plate (Part No. 5025) for leveling. Has 7/16" diameter hole which should be aligned with footplate hole to permit anchor bolting to floor.

2.1/2"	2-1/4"	1/8"	5026



5. H-POST COMBINATION CLIP. Zinc plated clip. Mounts to rear position H-Posts to provide anchor point for back sway braces. Also used to connect H-Posts and common back panels or common back sway braces together in back to back models. (Pat. Pend.)

_	-	-	5027



6. H-POST HORIZONTAL BEAMS, Channel shaped, 16 gauge, 3-1/2" high x 1-5/8" deep with a 3/4" x 5/8" step. 10 gauge beam connectors are welded to each end for mounting to H-Posts. Used in pairs along with tie bars as load supporting members with corrugated steel decking, plywood, or composition board decking forming the shelf surface. Also used to provide lateral bracing in lieu of backsway braces for widespan shelving in "passthrough" applications.

	- 1011	3-1/2"	5029-72
72"	1-5/8"	3-1/2"	5029-84
84"	1-5/8"		5029-96
96"	1-5/8"	3-1/2"	3020 00

Description Width Depth

Part Number

7. BEAM TIE BARS. Channel shaped sections with each end slotted at top and bottom for beam connection. Used as a cross-member between beams to prevent beam rotation and to provide additional support to limit deflection of decking, 1 tie bar is required for 72" beam spans; 2 tie bars, for 84" and 96" spans.



_	18"	_	5030-18
_	24"	_	5030-24
-	30"	-	5030-30
-	36"	-	5030-36
-	48"	-	5030-48



8. STANDARD SHELF REINFORCING CHANNELS. 12 gauge, 1" x 1-1/8" x 5/16" formed channels. Used along the width of underside of shelf for added load capacity on shelf Classes 1, 2, and 3.

36"	-	-	5082-36
42"	-	-	5082-42
48"	-	-	5082-48



9. SIDE PANELS. Provide closed sections where desired. Pierced on 12" centers for mounting to front and rear H-Posts. Attach with sheet metal screws.

5091-1803
E004 4007
5091-1807
5091-2403
5091-2407
5091-3003
5091-3007
5091-3603
5091-3607



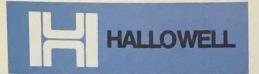
10. BACK PANELS. One-piece sections pierced on 1" centers at vertical edges and center for mounting to back of H-Posts and shelves in models up to 48" wide. For widespan models 72", 84", and 96" wide, use a back panel connector strip (Part No. 5113) to join two back panels of equal width together at the shalf center to fully enclose back.

36"	-	3'3"	5110-3603
36"	-	4'3"	5110-3604
36"	-	6'3"	5110-3606
36"	-	7'3"	5110-3607
42"	-	7'3"	5110-4207
48"	_	7'3"	5110-4807



11. BACK PANEL CLIP FOR STANDARD SHELVES. Spring steel. Formed to fit bottom flange of standard shelf and tabbed to pick up holes in center of back panel section. Holds back panel to shelf and prevents panel bowing.

5111



#### ERECTOMATIC HIGH DENSITY SHELVING COMPONENTS

Description Width Depth Height 12. BACK PANEL CLIP FOR WIDESPAN SHELVES. Mild steel. Formed to fit bottom flange of widespan shelf. Attaches to back panel, holding back panel to shelf to prevent panel bowing.



0

0

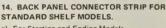
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13. BACK PANEL CONNECTOR STRIP FOR WIDESPAN SHELF MODELS. 4-3/4" wide steel strip, pierced on 1" centers. Used to join back panels of the same size (Part No. 5110- in 36", 42", and 48" widths) to form 72", 84", and 96" wide paneling. Panels are joined to strip and attach with standard 1/4 - 20 x 1/2 truss head screws and nuts.

Part Number

5112

4-3/4"	-	3'3"	5113-3
4-3/4"	-	7'3"	5113-7



a) For Starting and Ending Models. 2-1/16" wide steel strip, pierced at vertical edges on 1" centers for connecting back panels to outside rear H-Posts.

2-1/16"	-	3'3"	5114-3
2-1/16"	-	7'3"	5114-7

b) For Adjoining or Intermediate Models. 3-1/8" wide steel strip, pierced on 1" centers at outside vertical edges and down the center for connecting back panels to intermediate rear H-Posts.

3-1/8"	-	3'3"	5115-3
3-1/8"	-	7'3"	5115-7

15. STANDARD SHELVES (Class 0). 18 gauge cold rolled steel. Front and rear edges have triple formed flanges with box flanges on sides. All corners are lapped and welded for maximum strength. Top pierced on 1" centers for adjustment of dividers. Shelves 24" and deeper also have center piercing. Can be easily reinforced for additional load capacity.



36"	12"	-	5130-3612
36"	15"	-	5130-3615
36"	18"	-	5130-3618
36"	24"	-	5130-3624
36"	30"	-	5130-3630
36"	36"	-	5130-3636
42"	12"	-	5130-4212
42"	18"	-	5130-4218
42"	24"	-	5130-4224
42"	30"	-	5130-4230
42"	36"	-	5130-4236
48"	12"	-	5130-4812
48"	18"	-	5130-4818
48"	24"	-	5130-4824
48"	30"	-	5130-4830
48"	36"	-	5130-4836

Number

16. SHELF CLIP. One-piece compression clip, zinc plated. Fits snugly against side of post to hold shelves in place. For use with standard and widespan shelves. 4 required per shelf.



17. BOTTOM SHELF SUPPORT BRACES. Used only on Class 3 bottom shelves to support center reinforcing channels. Positioned at center of shelf;

5133

rests on floo	or,	 
		5135

18. SHELF SUPPORT BRACES. Used to support center reinforcing channels except on bottom shelf in Class 3 applications. 5136-18





19. BIN FRONTS. Offset type with bead at top and triple flange at bottom to telescope over shelf

36"	-	1"	5220-3601
36"	-	3"	5220-3603
42"	-	3"	5220-4203
48"	-	3"	5220-4803

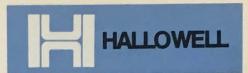
20. FULL DIVIDERS. Front edge beaded, Top, bottom and rear edges flanged. When 18" deep or more, top edge is notched for Class 3 reinforcing channels.



-	12"	6"	5240-1206
-	12"	9"	5240-1209
-	12"	12"	5240-1212
-	18"	6"	5240-1806
-	18"	9"	5240-1809
-	18"	12"	5240-1812
-	24"	6"	5240-2406
-	24"	9"	5240-2409
-	24"	12"	5240-2412

21. PARTIAL DIVIDERS. Partitions straight or sloping shelves from front to rear. Flanged and pierced for shelf attachment with top corners rounded for safety.

-	12"	2"	5250-1202
-	12"	4"	5250-1204
-	18"	2"	5250-1802
-	18"	4"	5250-1804
-	24"	2"	5250-2402
-	24"	4"	5250-2404



#### ERECTOMATIC HIGH DENSITY SHELVING COMPONENTS

Description

Depth

Description Part Number Width Depth Height 22. H-POST SIDE SWAY BRACES, 11 gauge, 1" x 1/8" steel strip with safety edges. One pair of braces are bolted together at the center to form

an "X". Ends are radiused and pierced for attaching to front and rear H-Posts in the side position. See technical section for bracing information, page 6.

-	12"	-	5341-12
_	15"	-	5341-15
	18"	-	5341-18
	24"	-	5341-24
-	30"	-	5341-30
	36"	-	5341-36
	48"	_	5341-48

23. BACK SWAY BRACES (Standard Shelves). 11 gauge, 1" x 1/8" steel strip with safety edges. One pair of braces are bolted together at center to form an "X". Ends are radiused and pierced for mounting to combination clip (Part No. 5027) attached to H-Posts in the rear position. See technical section, page 6, for bracing information.

36"	_	200	5342-44
42"	-	-	5342-55
48"	-	-	5342-55

24. H-POST BACK SWAY BRACES (Widespan Shelves). Set of four 11 gauge, 1" x 1/8" steel strip braces mounted to a 14 gauge tensioning disc. Disc rotates to pretension braces for maximum stability. Brace ends are radiused and pierced for mounting to combination clips (Part No. 5027) and bolt to rear position H-Posts. See technical section, page 6, for bracing information, (Pat. Pend.)

			5343-72
72"	-		5343-84
84"	paint .	-	5343-96
96"	-	-	0343-00

25. LABEL HOLDERS. Pierced for attaching to front flange of shelves with top and bottom edges folded over to accommodate labels approximately

1 1119111			5370-3601
36"		-	
		100 _	5370-4201
42"	-		5370-4801
48"	-	-	50,0

26. CORRUGATED STEEL DECKING SECTIONS. One-piece, ribbed steel panels. Fit into step of beams to provide a shelf surface. Supports a uniform load capacity equal to beam capacity, 36" wide sections have 5 ribs-4" wide, with 2" valleys between ribs; 24" wide sections, 3 ribs-4" wide, with 2" valleys between ribs.

36" 36" 36"	18" 24" 30" 36"	1111	5631-3618 5631-3624 5631-3630 5631-3636
36" 24" 24" 24" 24"	18" 24" 30"	- - - - nilable upor	5631-2418 5631-2424 5631-2430 5631-2436 request.)

Width 27. WIDESPAN SHELVES (U.S. Patent No. 3,556,309). For open shelf spans of 72", 84", and 96". Tubular flanged I-beam design with two I-beams running the entire width of the shelf to provide strength and rigidity. 18" and 24" deep shelves have a Z-shaped reinforcing bar located in the middle under the shelf top. 30" and 36" deep shelves have two such reinforcing bars, located equidistantly off-center beneath the shelf top. Shelf reinforcements are spot welded on 6" centers across the full shelf width. End channels

Height

Part Number

5700-9636

5706-84

5706-96

	ale alec it	olded.		
JAM S	72"	18"	-	5700-7218
MA	72"	24"	-	5700-7224
0	72"	30"	-	5700-7230
	72"	36"	-	5700-7236
	84"	18"	-	5700-8418
	84"	24"	-	5700-8424
	84"	30"	-	5700-8430
	84"	36"	-	5700-8436
	96"	18"	-	5700-9618
	96"	24"	-	5700-9624
	96"	30"		5700-9630

are also welded

96"

84"

96"

28. WIDESPAN BASE STRIPS. Fit between bottom shelf and floor on widespan shelving models to give a neat, finished appearance to unit. 5706-72 72"

36"

#### COMPONENTS FOR 48" DEEP MODELS (No. 5607, No. 5608, No. 5609)

29. HORIZONTAL BEAMS. Used in pairs along with tie bars as load supporting members for 96" x 48" plywood or composition board decking, 5/8" or 3/4" thick. 3-1/2" 5029-PW 1-5/8" 96"

R	30. TIE BARS. Used as cross beams to provide additional st tion of plywood or composition	upport and limit defle
2/	100	E020.49

31, SPREADER. Provides exact spacing between front and rear posts for 48" deep models. Two spreaders are required for 7'3" and 8'3" high models; three spreaders, for 10'3" and 12'3" high models. 5031-48 48"

1	32, SIDE SWAY BRACES. 11 gauge, 1" x 1/8" steel strip with safety edges. Braces are bolted together at center to form an "X". Ends are radiused and
1/	pierced for attaching to front and rear posts. One pair of braces are required for 7'3" and 8'3" high
X	models; two pair for 10'3" and 12'3" high models. See page 37 for typical elevations showing sway

brace useage. 5341-48 48"















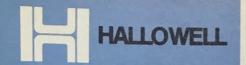


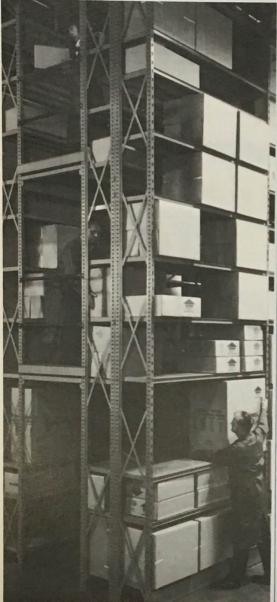






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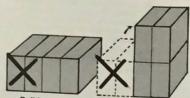




MULTI-LEVEL SHELVING offers significant increases in storage capability by simply expanding upwards instead of outwards. "Dead", overhead airspaces are transformed into active, efficient storage areas. Valuable floor space is freed for more profitable work utilization. Additional benefits are obtained in improved inventory control, stock visibility and accessability.

With ERECTOMATIC standard shelving using flush beaded front posts, installation of a multi-level storage system is obtained by simply stacking units of the same width and depth directly on top of a properly laid-out base system. These units are then joined at points of vertical support with standard connecting components plus standard stairs, rails, and other devices to provide safe access to and from upper levels.

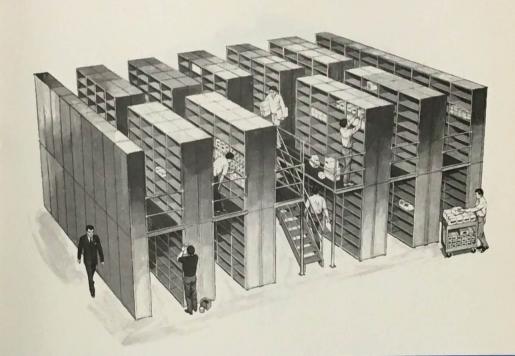
ERECTOMATIC high density shelving extends this capability with heavy duty H-posts and beams to handle wider unit widths and higher load capacities. Specific models of ERECTOMATIC standard and high density, multi-level shelving units are cataloged in this section along with the components required to erect a system.



Builds up, not out, freeing premium floor space for more profitable use.



MODEL 5800 (With Flush Beaded Front Posts)
180-36" wide shelving units (90 units, each level)



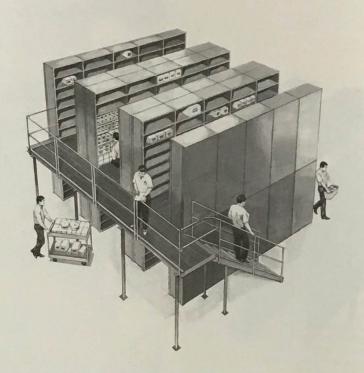
		Shelf Width	Shelf Depth	Height 1st Level	Height 2nd Level	Aisle Width	Size of Installation	Storage Space Cubic Feet
580 580 580 580 580	00-3618-14 00-3618-15 00-3618-16 00-3624-14 00-3624-15 00-3624-16	36" 36" 36" 36" 36"	18" 18" 18" 24" 24" 24"	7'3" 8'3" 8'3" 7'3" 8'3" 8'3"	7'3" 7'3" 8'3" 7'3" 7'3" 8'3"	36" 36" 36" 36" 36"	37'2" × 27'6" 37'2" × 27'6" 37'2" × 27'6" 43'2" × 27'6" 43'2" × 27'6" 43'2" × 27'6"	5670 6075 6480 7560 8100 8640

NOTES: Two components cannot be standardized because of variables in size in any given installation: the steel grating and 5".6.7 lb. channels. They must be purchased separately from a local supplier. See page 54 for specifications and reference drawing.



# MODEL 5810 (With Flush Beaded Front Posts)

60-36" wide shelving units (30 units, each level)



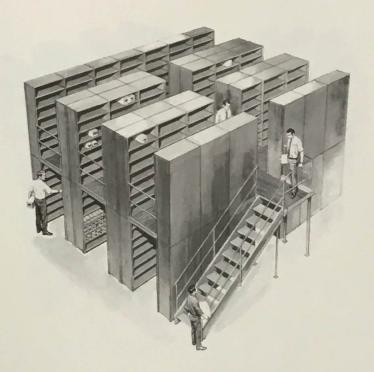
Model No.	Shelf Width	Shelf Depth	Height 1st Level	Height 2nd Level	Aisle Width	Size of	Storage Space
5810-3618-14	36"	18"	7'3"	7'3"		Installation	Cubic Feet
5810-3618-15	36"	18"	8'3"	7'3"	36"	21'8" x 18'4"	1890
5810-3618-16	36"	18"	8'3"	8'3"	36"	21'8" x 18'4"	2025
5810-3624-14	36"	24"	7'3"	7'3"	36"	21'8" x 18'4"	2160
5810-3624-15	36"	24"	8'3"	7'3"	36"	24'8" x 18'4"	2520
5810-3624-16	36"	24"	8'3"	8'3"	36" 36"	24'8" x 18'4"	2700
					30	24'8" x 18'4"	2880

NOTES: Two components cannot be standardized because of variables in size in any given installation: the steel grating and 5".6,7 lb. channels. They must be purchased separately from a local supplier. See page 54 for specifications and reference drawing.



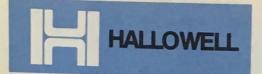
#### MODEL 5820 (With Flush Beaded Front Posts)

74-36" wide shelving units (37 units, each level)

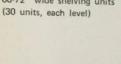


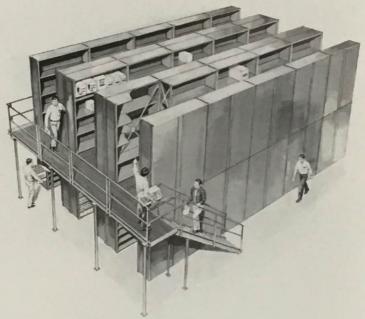
	01.4	Shelf	Height	Height 2nd Level	Aisle Width	Size of Installation	Storage Space Cubic Feet
Model No.	Shelf Width	Depth	1st Level	7'3"	36"	21'8" x 21'4" 21'8" x 21'4"	2331 2498
5820-3618-14 5820-3618-15 5820-3618-16 5820-3624-14 5820-3624-15	36" 36" 36" 36" 36"	18" 18" 18" 24" 24"	8'3" 8'3" 7'3" 8'3" 8'3"	7'3" 8'3" 7'3" 7'3" 8'3"	36" 36" 36" 36" 36"	21'8" x 21'4" 21'8" x 21'4" 24'8" x 21'4" 24'8" x 21'4" 24'8" x 21'4"	2665 3108 3330 3552

NOTES. Two components cannot be standardized because of variables in size in any given inst the steel grating and 5"-6.7 lb. channels. They must be purchased separately from a local supplier. See page 54 for specifications and reference drawing.



MODEL 5850 (With H-Posts) 60-72" wide shelving units

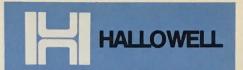




Model No.	Shelf Width	Shelf Depth	Height 1st Level	Height 2nd Level	Aisle Width	Size of Installation	Storage Space
5850-7218-14	72"	18"	7'3"	71011		installation	Cubic Feet
850-7218-15	72"	18"	8'3"	7'3"	36"	34' x 21'9"	3375
850-7218-16	72"	18"	8'3"	7'3"	36"	34' x 21'9"	3645
850-7224-14	72"	24"	7'3"	8'3"	36"	34" x 21'9"	3915
850-7224-15	72"	24"	8'3"	7'3"	36"	34' x 24'9"	4500
5850-7224-16	72"	24"	8'3"	7'3"	36"	34' x 24'9"	4860
NOTE: CL.				8'3"	36"	34' x 24'9"	5220

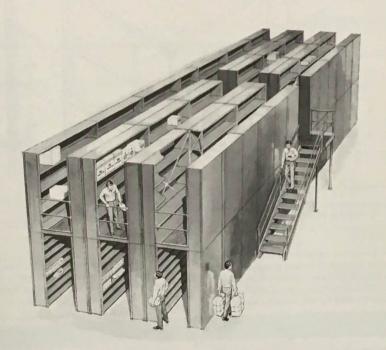
NOTE: Shelves on lower level are on 12" centers.
Upper level has 4 openings for bulk storage

Two components cannot be standardized because of variables in size in any given installation: the steel grating and  $5^{\prime\prime}$  -6.7 lb. channels. They must be purchased separately from a local supplier. See page 54 for specifications and reference drawing.



#### MODEL 5860 (With H-Posts)

74 Total Shelving Units (36-72" wide and 1-36" wide, each level)



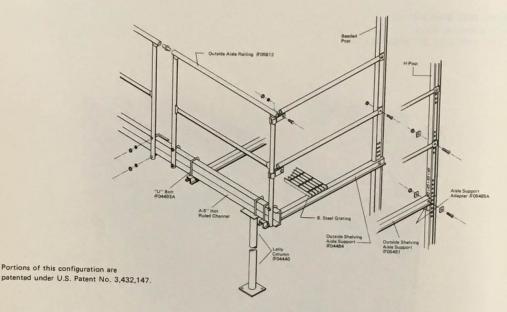
	Shelf	Shelf	Height 1st Level	Height 2nd Level	Aisle Width	Size of Installation	Cubic Feet
Model No.	Width	Depth	7'3"	7'3"	36"	40'1" x 21'9"	4050 4374
5860-7218-14 5860-7218-15 5860-7218-16 5860-7224-14	72" 72" 72" 72"	18" 18" 18" 24" 24"	8'3" 8'3" 7'3" 8'3"	7'3" 8'3" 7'3" 7'3" 8'3"	36" 36" 36" 36"	40'1" x 21'9" 40'1" x 21'9" 40'1" x 24'9" 40'1" x 24'9" 40'1" x 24'9"	4374 4698 5400 5832 6264
5860-7224-15 5860-7224-16	72"	24"	8'3"		nnot be standa	rdized because of var	iables in size

NOTE: Shelves on lower level are on 12" centers.
Upper level has 4 openings for bulk storage.

Two components cannot be standardized because of variables in size in any given installation: the steel grating and 5" -6.7 lb. channels. They must be purchased separately from a local supplier. See page 54 for specifications and reference drawing.



SPECIFICATIONS All models are closed type with base strips on lower level. Shelves are Class 0 on 12" centers. Mezzanine walkways are black steel grating with 1" x 1/8" bearing bars spaced on 1-3/16" centers with cross bars on 4" centers. They provide for a safe uniform loading of 125 lbs. per sq. ft. Stairways have safety hand railings and steel diamond plate safety treads. Safety railings and kickplates are located at ends of rows and around stairwells. Shipped knocked down for easy assembly.



Two components cannot be standardized because of variables in size in any given installation: the steel grating and 5"-6.7 lb. channels. They must be purchased separately from a local supplier. The drawing above illustrates an outside aisle and shows how and where these two components are used.

# A. 5"-6.7#/ft. hot rolled steel channel

Used in conjunction with standard pipe columns (Key #9) for attaching grating supports and railing sections on an outside aisle. Because grating supports are suspended from this channel, instead of resting on top of it, the channel also serves as a kick plate. The channel should be supported by pipe columns at approximately 12' intervals. The channel may be obtained from a structural steel warehouse or fabricator in lengths to suit the installation.

#### B. Steel Grating

Subway type steel grating is the most common material used as flooring at the upper level. Grating with bearing bars on

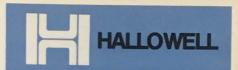
1-3/16" centers and cross bars on 4" centers is generally acceptable. Bearing bars usually are 3/4" x 1/8" or 1" x 1/8" depending on weight capacities needed. Weight loading charts are available from the grating manufacturer.

Grating is manufactured in two standard widths (nominal 24'' and 36'') with other widths being cut from these sizes. Since standard sizes of our grating supports are 36'', 42'' and 48'', gratings should be furnished in the following widths:

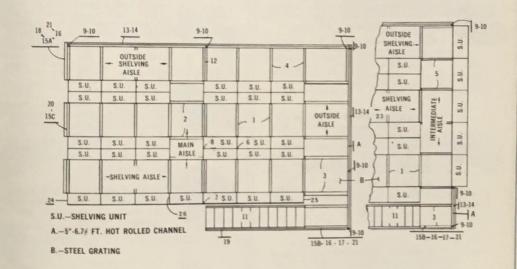
36" aisle—36" grating(standard)
42" aisle—24" grating(standard)
and —18" grating (cut from 36")
48" aisle—two pieces 24" grating(standard)

Standard grating length is 20 feet but because of physical weight should be ordered in shorter lengths to ease handling. Sizes will be determined by the aisle lengths and placement of grating supports. Grating joints must be made at the point of support using the grating joint angle (Key #12).

Saddle clips for fastening the grating to the supports are supplied by the manufacturer when specified. The standard color of grating is black. In addition to ERECTOMATIC standard shelving components shown on pages 26 to 32, there are a number of other components—stairways, railings, supports, etc. designed for use in Multi-Level shelving systems. The location of these components in a typical installation is shown below along with a component identification list. For complete part descriptions see pages 56 to 58.



ERECTOMATIC MULTI-LEVEL COMPONENTS (STANDARD SHELVING)



Key	Description	Part No.	Key	Description	Part No.
1 2 3 4 5 6 7 8 9 10 11 12 13	Shelving Aisle Support Main Aisle Support Outside Aisle Support Outside Aisle Support Intermediate Aisle Support Double Splice Channel Single Splice Channel End Splice Plate Pipe Column Outside Aisle "U" Bolt Stairways with Railing Grating Joint Angle Outside Aisle Railing "U" Bolt & Plug Outside Aisle Railing Section	04484 04482 04483 04484 04484 04480 04479 04481 04440 04493 05985 04478 05828 05812	15B 15C	Outside Aisle Unit End Railing Outside Aisle Stair End Center Railing Shelving Aisle End Railing Outside Shelving Aisle Unit End Railing Outside Shelving Aisle Unit End Railing Outside Aisle Stair End Top Railing Universal Clips Stair Railing (included with Stairs) Aisle End Channel Kick Plate Outside Aisle Angle Kick Plate Hardware Kit for Mounting Grating Plastic Coupling Aisle Support Brace (Right Hand) Aisle Support Brace (Right Hand) Aisle Support Brace (Intermediate)	05826 06041 05823 05825 05975A 06042 5315 04477 04490 04475 06818A 03466 03466



#### **ERECTOMATIC MULTI-LEVEL** COMPONENTS (STANDARD SHELVING)

	Description	THE REAL PROPERTY.	
Width	Depth	Height	Part Number



1. SHELVING AISLE SUPPORT. 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges. Supports grating and gives proper aisle width. Used for aisles having facing shelf openings. Also provides bearing surface for base of second level.

36"	-	1-3/4"	04484A
42"	_	1-3/4"	04484B
48"	-	1-3/4"	04484C



2. MAIN AISLE SUPPORT. 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges and pierced, closed ends for attaching to shelving aisle supports. Provides grating support and gives proper aisle width. Used at aisles between the end of one row and the beginning of another.

36"	-	1-3/4"	04482A
42"	-	1-3/4"	04482B
48"	-	1-3/4"	04482C



3. OUTSIDE AISLE SUPPORT, 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges and pierced, closed ends for attaching to shelving aisle supports. Provides grating support and gives proper aisle width. Used on outside aisles adjacent to row ends. Grating and outside aisle support are supported by a 5" channel on outer or railing side.

36"	-	1-3/4"	04483A
42"	-	1-3/4"	04483B
48"	-	1-3/4"	04483C

4. OUTSIDE SHELVING AISLE SUPPORT, 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges. Supports grating and gives proper aisle width. Used on aisles having a shelf front facing on one side with the other side supported by a 5" channel. Provides bearing surface for base of second level posts.

36"	-	1-3/4"	04484D
42"	-	1-3/4"	04484E
48"	-	1-3/4"	04484F

Description			
Width	Depth	Height	Part Number



5. INTERMEDIATE AISLE SUPPORT. 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges and pierced, closed end for attaching to shelving aisle support. Provides grating support and gives proper aisle width. Used on aisles where shelving front faces ends of shelving rows.

36"		1-3/4"	04484G
42"		1-3/4"	04484H
48"		1-3/4"	04484J
48"	-	1-3/4"	04484J



6. DOUBLE SPLICE CHANNEL. Provides bearing plate for base of second level posts. Notched and pierced for mounting to top of back to back T-posts.

_	1-1/2"	04480A



7. SINGLE SPLICE CHANNEL. 1-1/2" high channel with 2" side flanges, Pierced for mounting to T-posts. Provides bearing plate for base of second level posts.

-	_	1-1/2"	04479A



8. END SPLICE PLATE. Provides bearing plate for second level posts at ends of single or back to

back shelv	ing rows, A formed	I Mith two
flanges for	fastening to end r	ear posts.
		0.4401A



9. PIPE COLUMN. 1-1/2" standard pipe with two 7 gauge, 4" x 4" plates welded to top and bottom. Used to support 5" channel on outside aisles and outside shelving aisles.

-	7'3"	04440A
-	8'3"	044408



10. OUTSIDE AISLE "U" BOLT, 5/16" dia. steel rod formed into a "U" with threaded ends. Used to attach outside aisle and outside shelving aisle supports and pipe columns to 5" channel.

04493A



#### **ERECTOMATIC MULTI-LEVEL** COMPONENTS (STANDARD SHELVING)

Description

Description Part Number Width Depth Height

11. STAIRWAY WITH RAILING. Knocked down assembly consists of 10" x 1-1/2" channels, 1/8" diamond plate stair treads, two angle supports, and stair railing including all necessary hardware and fittings. Used for access to upper level floors. Conforms to OSHA requirements.

36"	-	7'3"	05985A
48"	-	7'3"	05985B
36"	-	8'3"	05985C
48"	-	8'3"	05985D

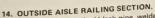
12. GRATING JOINT ANGLE. 1-5/16" x 1-1/16" formed angle, pierced for attaching to aisle supports. Provides additional space for mounting gratings at point of juncture.

36"	_	-	04478A
42"		_	04478B
42			04478C

13. OUTSIDE AISLE RAILING "U" BOLT AND PLUG. 5/16" diameter steel rod formed into a

"U" with threaded ends. Used for attaching outside aisle railing to 5" channel. Plug is used to close end of top rail of railing. Conforms to

_	0582



DI

1-5/8" Nom. O.D. standard black pipe, welded to form section. Uprights are pierced to take "U" bolts (Part No. 05828A). Section is used on outside aisle and attaches to 5" channel. Conforms to

OSITA 109			05812A
36"	-	-	05812B
48"	-	-	05812C
72"	-		



Part Number

FOR OUTSIDE AISLE UNIT END. 1-5/8" Nom. O.D. standard black pipe with one end flattened and pierced. The other end has a bracket welded to it for use with clamp bracket. Used to close off outside aisle where there is a shelving unit on one side. Conforms to OSHA requirements.

37-5/16" (for 36" aisle)	05826A
14" (for 42" aisle)	05826B
19-15/16" (for 48" aisle)	05826C

15B. OUTSIDE AISLE STAIR END CENTER RAIL

1-5/8" Nom. O.D. standard black pipe. One end is flattened and pierced. The other end has a bracket welded to it for use with clamp bracket. Used as a center rail when stairway railing connects to outside aisle. Conforms to OSHA requirements.

44-9/16" (for 36" aisle)	06041A
50-9/16" (for 42" aisle)	06041B
56.9/16" (for 48" aisle)	06041C

15C. SHELVING AISLE END RAILS. 1-5/8" Nom. O.D. standard black pipe with ends flattened and pierced for bolting to shelving posts. Used to close off end of shelving aisle. Conforms to OSHA requirements.

39-1/4" (for 36" aisle)	05823A
45-1/4" (for 42" aisle)	05823B
51-1/4" (for 48" aisle)	05823C

15D. TOP AND CENTER RAILING RAILS -FOR OUTSIDE SHELVING AISLE UNIT END. 1-5/8" Nom. O.D. standard black pipe. Ends have brackets welded to them for use with clamp brackets. Used to close off end of outside shelving aisle. Conforms to OSHA requirements.

-	39-17/32"	(for 36"	aisle)	
	45-17/32"	(for 42"	'aisle)	
	51-17/32"	(for 48"	aisle)	

05825A 05825B 05825C



# ERECTOMATIC MULTI-LEVEL COMPONENTS (STANDARD SHELVING)

Width  16, CLAMP clamp railing 05826) to or aisle ends.  —	g rails (Part utside aisle –	FOR RAIL Nos. 06041	INGS. Used to 06042, 05825 on uprights at 05975A
clamp railing 05826) to or aisle ends.	g rails (Part utside aisle –	Nos. 06041	06042, 05825 on uprights at
	-	-	05975A
	FND DAM		
welded to or Other end at with plastic	standard bla ne end for u ttaches to to coupling (P	ick pipe with use with clan op end of sta art No. 058	bracket np bracket. airway railing
36"	-	-	06042A
48"	-	_	06042B 06042C
top and cent	ter rails to si	helving post	on outside
mounting to shelving aisl	channel wi shelving po es. Installed	th 3/8" flang	ges, pierced for aisle ends in
x 1-1/2" for	rmed angle.	Pierced for	mounting to
grating. Use	orms to OSH	A requirement	ents.
grating. Use	orms to OSF	A"	04490A 04490B
	Other end a with plastic forms to OS 36" 42" 48" 18. UNIVE stotted for c three slots fit top and cen aisles and ou — 20. AISLE high formed mounting it shelving aisl requirement 36" 42" 48" 21. OUTSII	Other end attaches to twith plastic coupling (P forms to OSHA require 36" — 42" — 48" — 18. UNIVERSAL CLIP slotted for clamp bracks three slots for mounting top and center rails to a sisles and outside intern — — 20. AISLE END CHAN high formed channel will mounting to shelving aisles. Installed requirements. 36" — 42" — 48" — 21. OUTSIDE AISLE A	Other end attaches to top end of stawith plastic coupling (Part No. 058: forms to OSHA requirements.  36" — — — — — — — — — — — — — — — — — — —

S. B. B. S. B.	Description			A STATE OF THE STA
	Width	Depth	Height	Part Number



 PLASTIC COUPLING. Used to join top rails of outside aisle railing sections to provide a continuous top hand rail.

05818A

24. AISLE SUPPORT BRACE, INTERMEDIATE. Formed channel with mounting brackets. Used at all intermediate sides to furnish added lateral bracing required for Seismic Zone 3.

12"	-	-	03466A
15"	-	-	03466B
18"	-	-	03466C
24"	-	-	03466D
30"	-	_	03466E
36"	-	-	03466F



25. AISLE SUPPORT BRACE, RIGHT HAND. Formed channel with mounting brackets for attachment to front and rear posts at left hand end of

shelving row to supply added lateral bracing needed for Seismic Zone 3.

12"	-	-	03466G
15"	-	-	03466H
18"	-	-	03466J
24"	-	-	03466K
30"	-	-	03466L
36"	-	_	03466M



26. AISLE SUPPORT BRACE, LEFT HAND.

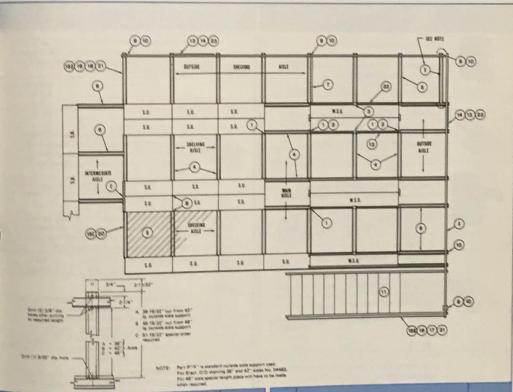
Channel formed with mounting brackets for attachment to front and rear posts at right hand end of shelving row to supply added lateral bracing needed for Seismic Zone 3.

12"	_		03466N
15"	-	_	03466P
18"	-	-	034660
24"	-	-	03466R
30"	-	-	034665
36"	-	-	034667



The Multi-Level components needed for a high density system are located below in a typical layout and identified as to part number. See pages 60 and 61 for complete parts descriptions.

ERECTOMATIC MULTI-LEVEL COMPONENTS (HIGH DENSITY SHELVING)



Kev	Description	Part No.	Key	Description	Part No.
1 2 3 4 6 6 7 8 9 10 11 12	Aisle Support Adapter Aisle Support Adapter Post Spacer Aisle Support Adapter Hanger Shelving or Main Aisle Support Outside Shelving Aisle or Outside Aisle Support Intermediate Aisle Support Grating Joint Angle H-Post Splice Pipe Column Outside Aisle "U" Bolt Stairway with Railing Horizontal Beem	05484 05485 05701 05489 05491 05490 05718 5010 04440 04493 05985 5029	15B	Outside Aisle Railing "U" Bolt and plug Outside Aisle Railing Section Outside Aisle Unit End Railing Outside Aisle Stair End Center Railing Outside Aisle Stair End Center Railing Oltside Shelving Aisle Unit End Railing Clamp Bracket for Railing Stair End Railing Top Rail Universal Clip Stair Railing (included with stairs) Aisle End Channel Kick Plate Outside Aisle Angle Kick Plate Hardware Kit for Mounting Grating Plastic Coupling	05828 05812 05826 06041 05823 05826 05975 06042 5315 04477 04490 04476 05818



#### **ERECTOMATIC MULTI-LEVEL** COMPONENTS (HIGH DENSITY SHELVING)

Description Part Number Width Depth Height 1. AISLE SUPPORT ADAPTER. Channel shaped and pierced for attachment to H-Post. Used as anchor point for cross aisle supports. 1-1/4" 1-1/8" 3-7/8" 05484A 2. AISLE SUPPORT ADAPTER POST SPACER. Pierced for mounting to H-Post. Used for starting or ending models with horizontal beams. Provides flat surface on front of H-Post for mounting of aisle support adapter (Part No. 05484A). 3-3/4" 1-5/16" 05485A 3. AISLE SUPPORT ADAPTER HANGER. Channel shaped. Welded to aisle support adapter (Part No. 05484A). Fits over horizontal beam to accept aisle support at mid point of beam. 05701A



4. SHELVING OR MAIN AISLE SUPPORT. 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges. Pierced for mounting to aisle support adapter (Part No. 05484A). Provides grating support and exact spacing between H-Posts -36", 42", or 48". Used for aisles having facing shelf fronts and between ends of shelving rows.

36"	-	1-3/4"	05489A
42"	-	1-3/4"	05489B
48"	-	1-3/4"	05489C



5. OUTSIDE SHELVING AISLE OR OUTSIDE AISLE SUPPORT. 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges. Pierced for mounting to aisle support adapter (Part No. 05484A) and outside aisle 5" channel. Provides grating support and exact 36", 42", or 48" spacings between H-Posts for outside shelving aisles.

36"	-	1-3/4"	05491A
42"	-	1-3/4"	05491B
48"	-	1-3/4"	05491C



6. INTERMEDIATE AISLE SUPPORT. 1-3/4" high HAT section, 1-7/16" wide at top with 7/16" bottom flanges and closed, pierced ends for attaching to shelving aisle supports. Provides grating support and gives proper aisle width. Used on aisles where shelving front faces ends of shelving rows,

36"	-	1-3/4"	05490A
42"	-	1-3/4"	05490B
48"	-	1-3/4"	05490C

		Description		
525	Width	Depth	Height	Part Number
	formed ar	ngle, pierce additional s	d for mounti	-5/16" x 1-1/16" ng to aisle supports. Inting gratings at
		-	-	05718A
	-	-	-	05718B
	_	_		05718C



8. H-POST SPLICE. Channel shaped to fit inside two connecting posts with 4-7/8" overlap on ton

strength a	om. Pierced at the splice	for bolting. Ma without interfer accessories.	intains post
-	-	9-3/4"	5010

9. PIPE COLUMN, 1-7/8" Nom, O.D. standard pipe with two 7 gauge, 4" x 4" plates welded to

top and be outside ais	les and o	sed to support utside shelving	5" channel on aisles.
-	-	7'3"	044404

8'3"

04440B



10. OUTSIDE AISLE "U" BOLT. 5/16" dia. steel rod formed into a "U" with threaded ends. Used to attach outside aisle and outside shelving aisle supports and pipe columns to 5" channel.

-	-	04493A



11. STAIRWAY WITH RAILING. Knocked down assembly consists of 10" x 1-1/2" channels, 1/8" diamond plate stair treads, two angle supports, and stair railing including all necessary hardware and fittings. Used for access to upper level floors. Conforms to OSHA requirements.

36"	-	7'3"	05985A
48"	-	7'3"	05985B
36"	-	8'3"	059850
48"	-	8'3"	05985D



12. HORIZONTAL BEAM. Channel shaped beam, 16 gauge, 3-1/2" high with 5/8" step for 3/4" or 5/8" thick plywood or composition board decking. 10 gauge beam connectors are welded on each and for mounting to H-Posts. Supports alternate aisle supports at mid-span for widespan, multi-level shelving.

72"	_		F000 70
84"			5029-72
96"		-	5029-84
			E020.06



# ERECTOMATIC MULTI-LEVEL COMPONENTS (HIGH DENSITY SHELVING)

	SAME		escription					Description		Part Number
		Width	Depth	Height	Part Number		Width	Depth	Height	rait (valide)
1	7	PLUG. 5/10 Used for att	6" dia, ste taching ou to close e	el rod with tside aisle ra nd of top ra	"U" BOLT AND threaded ends, siling to 5" channel, il of railing. Con-	Q2	to clamp i	railing rails (826) to ou	(Part Nos. 06	ILINGS. Used 6041, 06042, ling section up-
		-	-	_	05828A		-	_	_	05975A
		Nom. O.D. section. Up (Part No. 0	standard orights are 05828A). S ttaches to	black pipe, pierced to t Section is us 5" channel.	SECTION, 1-5/8" welded to form ake "U" bolts ed on outside Conforms to	10	Nom. O.D. to one end attaches t	d for use wi to top end o Part No. 05	black pipe wi th clamp bra of stairway ra	RAIL. 1-5/8" th bracket welded cket. Other end iling with plastic forms to OSHA
	B	36" 48" 72"			05812A 05812B 05812C	1	36" 42" 48"		-	06042A 06042B 06042C
		15A. TOP FOR OUT O.D. stand and pierce to it for us outside als	SIDE AIS dard black d. The oth se with classes where the	pipe with oner end has a timp bracket there is a she	LING RAILS— ND. 15/8" Nom. ne end flattened b bracket welded Used to close off plying unit on one		slotted fo three slot top and o	r clamp bra s for mount enter rails t	cket attachm	
		side. Conf	forms to C	SHA requir			-	-	-	5315
		44" 49-5/16 15B. OU RAIL. 1- end is flat	5/8" Nom	'aisle) 'aisle) SLE STAIR O.D. stand	05826A 05826B 05826C END CENTER lard black pipe. One e other end has a h clamp bracket.		4" high for mount in shelving requirement 36"	ormed chan ting to shel g aisles. Ins	ving post. Us talled height	' flanges, pierced ed on aisle ends conforms to OSHA 04477A
1		Hend as a	center rai	I when stairs	way railing connects		42" 48"		4"	04477B 04477C
		44-9/16 50-9/16 56-9/16	6" (for 36 6" (for 42 6" (for 48	" aisle) " aisle) " aisle)	06041A 06041B 06041C		21. OUT: x 1-1/2" grating.	formed ang Used at end	E ANGLE KI le. Pierced for s of outside a	CK PLATE. 4" or mounting to iisles. Installed
W. Comment	1	Nom. O.I	D. standar ed for bol end of she	d black pipe	with ends flattened ing posts. Used to Conforms to OSHA	38	height co 36" 42" 48"	nforms to 0	SHA require 4" 4" 4"	04490A 04490B 04490C
		39-1/4 45-1/4 51-1/4	" (for 36" " (for 42" " (for 48"	aisle)	05823A 05823B 05823C	- Ariman-	GRATIN tion with Grating s	GS. Sheet grating sad addle clips	dle clips, 100 are normally	UNTING used in conjunc- screws per kit. supplied by the
			TOIDE CL	JEI VING A	ILING RAILS— ISLE UNIT END.		grating m	anufacture	1	
	3	1-5/8" No brackets brackets aisle. Co	om. O.D. welded to . Used to on nforms to	standard bla them for us close off end OSHA requ	se with clamp		of outsid	STIC COUP e aisle railin us top hand	g sections to	to join top rails provide a
		45-17	32" (for 3	12" aisle)	05825B		_	1 -	-	05818A
		51-17	/32" (for 4	18" aisle)	05825C					6

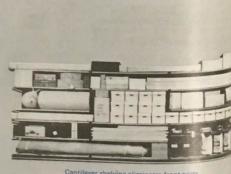


ELIMINATES FRONT POSTS Hallowell offers a unique concept in storage shelving that provides unobstructed access to shelf-stored items that are too long for ordinary shelving, too light to be stored on heavy duty racks, and too valuable to be exposed to open floor stocking. Small items, also, are all too often not accommodated by conventional shelving because of front post obstruction.

Until now, these problems were to a great degree unsolvable with existing shelving design. Hallowell cantilever shelving changes all that. With these new major part categoriesbase assemblies, arms, joining webs for H-Post uprights, and lateral bracing components - plus widespan and standard shelves, you can create your own cantilever shelving model that will best suit your particular need. Or, you can choose from the selection of models shown here.

Models are 7'3", 8'3", and 10'3" high, single or double-faced, in shelf widths of 36" to 96"; shelf depths of 18", 24", and 30". Ideal for all types of retail merchandising, plus many industrial and commercial applications as well.





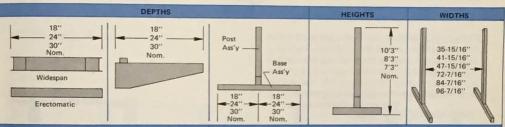
Cantilever shelving eliminates front posts

# SIZES, DIMENSIONS, AND LATERAL BRACING

The tables below illustrate the high degree of flexibility obtainable with Erectomatic Cantilever shelving. Three depths, three heights, six widths, single face and double face units which can be arranged to accommodate a very broad spectrum of dimensional requirements. Lateral bracing schemes which differ between single and double faced arrangements are also shown.

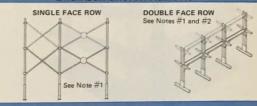


#### **ERECTOMATIC CANTILEVER SHELVING**



#### DIMENSIONS

#### LATERAL BRACING ARRANGEMENTS



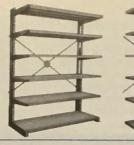
Depth of Unit	Maximum Weight (lbs.)										
	Per Shelf Width		Approx. Shelf Deflect. Across Front Flange	Per Arm	Per Single Face Upright*	Per Double Face Upright*					
18"	36" 42" 48" 72" 84" 96"	700 425 325 800 800 775	5/16" 5/16" 5/16" 1/4" 7/16" 17/32"	800	4000	4000 + 4000					
24"	36" 42" 48" 72" 84" 96"	700 425 325 700 700 700	5/16" 5/16" 5/16" 1/4" 5/16" 17/32"	700	3500	3500 + 3500					
30"	36" 42" 48" 72" 84" 96"	550 550 325 550 550 550	5/16" 5/16" 1/4" 3/16" 7/32" 3/8"	550	2750	2750 + 2750					

LOAD CAPACITIES. The table above shows the load capacity per shelf, per cantilever arm, and per single and double face upright. All weights shown are for evenly distributed, non-impact loads. The figures indicate maximum capacities of the components based on a 1.65 safety factor. In no case should shelf loads exceed the load capacity of the cantilever arms or uprights. Where heavier than normal loads are required, narrower shelf spans (down to 36") should be considered for maximum load capacity.

#### NOTES:

- 1. Two sets of back braces are required on 10'3" high models.
- The double face model brace must bolt thru two adjacent shelf arms at approximately the center of each vertical upright, and at the top of each 10'3" high upright, thus making these arms non-adjustable.
- \*3. Plus weight on lower shelf which attaches to the base of the upright. This shelf is not included when computing upright capacities.







or Starting Model Right Adjoining Model

SINGLE FACE MODELS For location against partitions or walls to provide frontal access and display. No front posts to obstruct. Ideal for storage of long, bulky items. 7'3", 8'3", and 10'3" heights; shelf widths of 72", 84", and 96"; shelf depths of 18", 24", and 30". See page 63 for shelf loading capacities and bracing information.



**MODEL 5730** 

W W

**MODEL 5731** 

72

A-5731-9630-10

	Shelf		3 adjustable shelves 1 fixed shelf Shelf			Shelf		4 adjustable shelves 1 fixed shelf		
	Charles Street	Height	Starting	Adjoining	Width	1	Height	Starting	Adjoining	
72" 72" 72"	18" 18" 18"	7" 8" 10'	5730-7218-7 5730-7218-8 5730-7218-10	A-5730-7218-7 A-5730-7218-8 A-5730-7218-10	72" 72" 72"	18" 18"	7' 8' 10'	5731-7218-7 5731-7218-8 5731-7218-10	A-5731-7218-7 A-5731-7218-8 A-5731-7218-10	
84" 84" 84"	18" 18" 18"	7' 8' 10'	5730-8418-7 5730-8418-8 5730-8418-10	A-5730-8418-7 A-5730-8418-8 A-5730-8418-10	84" 84" 84"	18" 18" 18"	7' 8' 10'	5731-8418-7 5731-8418-8 5731-8418-10	A-5731-8418-7 A-5731-8418-8 A-5730-8418-10	
96" 96"	18" 18" 18"	7' 8' 10'	5730-9618-7 5730-9618-8 5730-9618-10	A-5730-9618-7 A-5730-9618-8 A-5730-9618-10	96" 96" 96"	18" 18" 18"	7' 8' 10'	5731-9618-7 5731-9618-8 5731-9618-10	A-5731-9618-7 A-5731-9618-8 A-5731-9618-10	
72" 72" 72"	24" 24" 24"	7' 8' 10'	5730-7224-7 5730-7224-8 5730-7224-10	A-5730-7224-7 A-5730-7224-8 A-5730-7224-10	72" 72" 72"	24" 24" 24"	7' 8' 10'	5731-7224-7 5731-7224-8 5731-7224-10	A-5731-7224-7 A-5731-7224-8 A-5731-7224-10	
84" 84" 84"	24" 24" 24"	7' 8' 10'	5730-8424-7 5730-8424-8 5730-8424-10	A-5730-8424-7 A-5730-8424-8 A-5730-8424-10	84" 84" 84"	24" 24" 24"	7' 8' 10'	5731-8424-7 5731-8424-8 5731-8424-10	A-5731-8424-7 A-5731-8424-8	
96" 96" 96"	24" 24" 24"	7' 8' 10'	5730-9624-7 5730-9624-8 5730-9624-10	A-5730-9624-7 A-5730-9624-8 A-5730-9624-10	96" 96" 96"	24" 24" 24"	7' 8' 10'	5731-9624-7 5731-9624-8	A-5731-8424-10 A-5731-9624-7 A-5731-9624-8	
72" 72" 72"	30" 30"	7' 8' 10'	5730-7230-7 5730-7230-8 5730-7230-10	A-5730-7230-7 A-5730-7230-8 A-5730-7230-10	72" 72" 72"	30" 30"	7' 8' 10'	5731-9624-10 5731-7230-7 5731-7230-8	A-5731-9624-10 A-5731-7230-7 A-5731-7230-8	
84" 84" 84"	30" 30"	7' 8' 10'	5730-8430-7 5730-8430-8 5730-8430-10	A-5730-8430-7 A-5730-8430-8 A-5730-8430-10	84" 84" 84"	30"	7' 8' 10'	5731-7230-10 5731-8430-7 5731-8430-8	A-5731-7230-10 A-5731-8430-7 A-5731-8430-8	
96" 96" 96"	30" 30"	7' 8' 10'	5730-9630-7 5730-9630-8 5730-9630-10	A-5730-9630-7 A-5730-9630-8 A-5730-9630-10	96" 96" 96"	30"	7' 8' 10'	5731-8430-10 5731-9630-7 5731-9630-8 5731-9630-10	A-5731-8430-10 A-5731-9630-7 A-5731-9630-8	

5731-9630-10



#### SINGLE FACED MODELS (Continued)



#### **MODEL 5732**

5 adjustable shelves 1 fixed shelf

Shelf				
Width	Depth	Height	Starting	Adjoining
72" 72" 72"	18" 18" 18"	7' 8' 10'	5732-7218-7 5732-7218-8 5732-7218-10	A-5732-7218-7 A-5732-7218-8 A-5732-7218-10
84" 84" 84"	18" 18" 18"	7' 8' 10'	5732-8418-7 5732-8418-8 5732-8418-10	A-5732-8418-7 A-5732-8418-8 A-5732-8418-10
96" 96"	18" 18" 18"	7' 8' 10'	5732-9618-7 5732-9618-8 5732-9618-10	A-5732-9618-7 A-5732-9618-8 A-5732-9618-10
72" 72" 72"	24" 24" 24"	7' 8' 10'	5732-7224-7 5732-7224-8 5732-7224-10	A-5732-7224-7 A-5732-7224-8 A-5732-7224-10
84" 84" 84"	24" 24" 24"	7' 8' 10'	5732-8424-7 5732-8424-8 5732-8424-10	A-5732-8424-7 A-5732-8424-8 A-5732-8424-10
96" 96"	24" 24" 24"	7' 8' 10'	5732-9624-7 5732-9624-8 5732-9624-10	A-5732-9624-7 A-5732-9624-8 A-5732-9624-10
72" 72" 72"	30"	7' 8' 10'	5732-7230-7 5732-7230-8 5732-7230-10	A-5732-7230-7 A-5732-7230-8 A-5732-7230-10
84" 84" 84"	30"	7' 8' 10'	5732-8430-7 5732-8430-8 5732-8430-10	A-5732-8430-7 A-5732-8430-8 A-5732-8430-10
96" 96"	30" 30"	7' 8' 10'	5732-9630-7 5732-9630-8 5732-9630-10	A-5732-9630-7 A-5732-9630-8 A-5732-9630-10

DOUBLE FACE MODELS For island storage or display in areas where shelf access from front and back is desired. No front posts to obstruct. Ideal for storage of long, bulky items. 7'3", 8'3", and 10'3" heights; shelf widths of 72", 84", and 96"; shelf depths of 36", 48", 60". See page 63 for shelf loading capacities and bracing information.



#### **MODEL 5740**

6 adjustable shelves 2 fixed shelves \*See lateral bracing measurements, page 63

	Stien			
Width	Depth	Height	Starting	Adjoining
	36"	7'	5740-7236-7	A-5740-7236-7
72"	36"	8'	5740-7236-8	A-5740-7236-8
72"	36"	10'	5740-7236-10	A-5740-7236-10
84"	36"	7'	5740-8436-7	A-5740-8436-7
	36"	8'	5740-8436-8	A-5740-8436-8
84"	36"	10'	5740-8436-10	A-5740-8436-10
	36"	7'	5740-9636-7	A-5740-9636-7
96"	36"	8'	5740-9636-8	A-5740-9636-8
96"	36"	10'	5740-9636-10	A-5740-9636-10
	10000	7'	5740-7248-7	A-5740-7248-7
72"	48"	8'	5740-7248-8	A-5740-7248-8
72"	48"	10'	5740-7248-10	A-5740-7248-10
72"		-	5740-8448-7	A-5740-8448-7
84"	48"	7'	5740-8448-8	A-5740-8448-8
84"	48"	8'	5740-8448-10	A-5740-8448-10
84"	48"		5740-9648-7	A-5740-9648-7
96"	48"	7'	5740-9648-8	A-5740-9648-8
96"	48"	8'	5740-9648-10	A-5740-9648-10
96"	48"	10'		A-5740-7260-7
72"	60"	7'	5740-7260-7	A-5740-7260-8
72"	60"	8'	5740-7260-8	A-5740-7260-10
72"	60"	10'	5740-7260-10	A-5740-8460-7
84"	60"	7'	5740-8460-7	A-5740-8460-7 A-5740-8460-8
	60"	8'	5740-8460-8	A-5740-8460-10
84"	60"	10'	5740-8460-10	
	60"	7'	5740-9660-7	A-5740-9660-7
96"	60"	8'	5740-9660-8	A-5740-9660-8
96"	60"	10'	5740-9660-10	A-5740-9660-10
96"	80	10		







# **DOUBLE FACE MODELS (Continued)**



#### **MODEL 5741**

8 adjustable shelves 2 fixed shelves See lateral bracing arrangements, page 63.



#### **MODEL 5742**

10 adjustable shelves 2 fixed shelves

							See lateral bracing arrangements, page 63.		
Width 72"	Contract Contract	Height	Starting	Adjoining	Width	Shelf  Depth	Height	Starting	Adjoining
72" 72" 72"	36" 36" 36"	7' 8' 10'	5741-7236-7 5741-7236-8 5741-7236-10	A-5741-7236-7 A-5741-7236-8 A-5741-7236-10	72" 72" 72"	36" 36" 36"	7' 8' 10'	5742-7236-7 5742-7236-8 5742-7236-10	A-5742-7236-7 A-5742-7236-8 A-5742-7236-10
84" 84"	36" 36" 36"	7' 8' 10'	5741-8436-7 5741-8436-8 5741-8436-10	A-5741-8436-7 A-5741-8436-8 A-5741-8436-10	84" 84" 84"	36" 36" 36"	7' 8' 10'	5742-7236-7 5742-7236-8 5742-7236-10	A-5742-7236-7 A-5742-7236-8 A-5742-7236-10
96" 96" 96"	36" 36"	7' 8' 10'	5741-9636-7 5741-9636-8 5741-9636-10	A-5741-9636-7 A-5741-9636-8 A-5741-9636-10	96" 96" 96"	36" 36"	7' 8' 10'	5742-9636-7 5742-9636-8 5742-9636-10	A-5742-9636-7 A-5742-9636-8 A-5742-9636-10
72" 72" 72"	48" 48" 48"	7' 8' 10'	5741-7248-7 5741-7248-8 5741-7248-10	A-5741-7248-7 A-5741-7248-8 A-5741-7248-10	72" 72" 72"	48" 48" 48"	7' 8' 10'	5742-7248-7 5742-7248-8 5742-7248-10	A-5742-7248-7 A-5742-7248-8
84" 84" 96"	48" 48" 48"	7' 8' 10'	5741-8448-7 5741-8448-8 5741-8448-10	A-5741-8448-7 A-5741-8448-8 A-5741-8448-10	84" 84" 84"	48" 48" 48"	7' 8' 10'	5742-8448-7 5742-8448-8 5742-8448-10	A-5742-7248-10 A-5742-8448-7 A-5742-8448-8
96" 96" 72"	48" 48" 48"	7' 8' 10'	5741-9648-7 5741-9648-8 5741-9648-10	A-5741-9648-7 A-5741-9648-8 A-5741-9648-10	96" 96"	48" 48" 48"	7' 8' 10'	5742-9648-7 5742-9648-8 5742-9648-10	A-5742-9448-10 A-5742-9648-7 A-5742-9648-8
72" 72" 84"	60" 60"	7' 8' 10'	5741-7260-7 5741-7260-8 5741-7260-10	A-5741-7260-7 A-5741-7260-8 A-5741-7260-10	72" 72" 72"	60"	7' 8' 10'	5742-7260-7 5742-7260-8 5742-7260-10	A-5742-9648-10 A-5742-7260-7 A-5742-7260-8
84" 84" 96"	60" 60" 60"	7' 8' 10'	5741-8460-7 5741-8460-8 5741-8460-10	A-5741-8460-7 A-5741-8460-8 A-5741-8460-10	84" 84" 84"	60" 60"	7' 8' 10'	5742-8460-7 5742-8460-8	A-5742-8460-7 A-5742-8460-8
96"	60"	7' 8' 10'	5741-9660-7 5741-9660-8 5741-9660-10	A-5741-9660-7 A-5741-9660-8 A-5741-9660-10	96" 96" 96"	60"	7' 8' 10'	5742-8460-10 5742-9660-7 5742-9660-8 5742-9660-10	A-5742-8460-10 A-5742-9660-7 A-5742-9660-8 A-5742-9660-10







COMBINATION MODELS Provide open shelf storage plus a shelf-spanning utility rod to hold spools, rolls, reels, or hanging garments and materials. Heights of 7'3", 8'3", and 10'3"; shelf widths of 72", 84", and 96". Single face

models have shelf depths of 18", 24", and 30"; double face models, 36", 48", and 60". See page 63 for shelf loading capacities and bracing information.





	131	

Single Face 3 adjustable shelves

1 utility rod 1 fixed shelf

Utility rod can be attached to any size shelf arms.

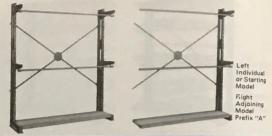
# MODEL 5751

Double Face
4 adjustable shelves
2 utility rods
4 fixed shelves

Utility rod can be attached to any size shelf arms.
See lateral bracing arrangements, page 63

			orinity root out	AND DESCRIPTION OF THE PARTY OF					
Width	Shelf	Height	Starting	Adjoining	Width	Shelf Depth	Height	Starting	Adjoining
72" 72" 72"	18" 18"	7' 8' 10'	5750-7218-7 5750-7218-8 5750-7218-10	A-5750-7218-7 A-5750-7218-8 A-5750-7218-10	72" 72" 72"	36" 36" 36"	7' 8' 10'	5751-7236-7 5751-7236-8 5751-7236-10	A-5751-7236-7 A-5751-7236-8 A-5751-7236-10
84" 84" 84"	18" 18" 18"	7' 8'	5750-8418-7 5750-8418-8	A-5750-8418-7 A-5750-8418-8 A-5750-8418-10	84" 84" 84"	36" 36" 36"	7' 8' 10'	5751-8436-7 5751-8436-8 5751-8436-10	A-5751-8436-7 A-5751-8436-8 A-5751-8436-10
96" 96" 96"	18"	10' 7' 8'	5750-9418-7 5750-9618-7 5750-9618-8	A-5750-9618-7 A-5750-9618-8 A-5750-9618-10	96" 96" 96"	36" 36" 36"	7' 8' 10'	5751-9636-7 5751-9636-8 5751-9636-10	A-5751-9636-7 A-5751-9636-8 A-5751-9636-10
72" 72"	18" 24" 24"	10' 7' 8'	5750-9618-10 5750-7224-7 5750-7224-8	A-5750-7224-7 A-5750-7224-8 A-5750-7224-10	72" 72" 72"	48" 48"	7' 8' 10'	5751-7248-7 5751-7248-8 5751-7248-10	A-5751-7248-7 A-5751-7248-8 A-5751-7248-10
72" 84" 84"	24" 24" 24"	10'	5750-7224-10 5750-8424-7 5750-8424-8	A-5750-8424-7 A-5750-8424-8	84" 84" 84"	48" 48" 48"	7' 8' 10'	5751-8448-7 5751-8448-8 5751-8448-10	A-5751-8448-7 A-5751-8448-8 A-5751-8448-10
96" 96"	24" 24" 24"	10'	5750-8424-10 5750-9624-7 5750-9624-8	A-5750-8424-10 A-5750-9624-7 A-5750-9624-8	96" 96" 96"	48" 48" 48"	7' 8' 10'	5751-9648-7 5751-9648-8 5751-9648-10	A-5751-9648-7 A-5751-9648-8 A-5751-9648-10
96" 72" 72"	30"	10'	5750-9624-10 5750-7230-7	A-5750-9624-10 A-5750-7230-7 A-5750-7230-8	72" 72"	60"	7' 8' 10'	5751-7260-7 5751-7260-8 6751-7260-10	A-5751-7260-7 A-5751-7260-8 A-5751-7260-10
72" 84" 84"	30"	8' 10' 7'	5750-7230-8 5750-7230-10 5750-8430-7	A-5750-7230-10 A-5750-8430-7 A-5750-8430-8	72" 84" 84"	60" 60"	7' 8'	5751-8460-7 5751-8460-8 5751-8460-10	A-5751-8460-7 A-5751-8460-8 A-5751-8460-10
96"	30"	8' 10'	5750-8430-8 5750-8430-10 5750-9630-7	A-5750-8430-10 A-5750-9630-7	96" 96"	60" 60"	10' 7' 8'	5751-9660-7 5751-9660-8	A-5751-9660-7 A-5751-9660-8 A-5751-9660-10
96"	30"	8' 10'	5750-9630-8 5750-9630-10	A-5750-9630-8 A-5750-9630-10	96"	60"	10'	5751-9660-10	A-5/-5/19000-10





UTILITY OR GARMENT ROD MODELS Provide ideal garment hanging space for clotheirs, dry cleaners, laundries, etc. Also used as utility storage to hold rolls, reels, or spooled materials such as wire, cloth, or plastic film. Single and double face. Heights of 7'3", and 8'3", rod widths of 72", 84", and 96"; depths of 18" and 36". See page 63 for capacity and bracing information.





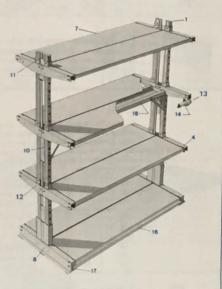
MODEL 5760 Single Face 2 Adjustable Rods Shelf Width Depth Height Starting Adjustes			Shelf		MODEL 5761  Double Face 2 Adjustable Rods 2 Fixed Rods* *Double faced models have a fixed intermediate arm position.				
Width	Depth	Height	Starting	Adjoining	Width	Depth	Height	Starting	Adjoining
72" 72"	18" 18"	7' 8'	5760-7218-7 5760-7218-8	A-5760-7218-7 A-5760-7218-8	72" 72"	36" 36"	7' 8'	5761-7236-7 5761-7236-8	A-5761-7236-7 A-5761-7236-8
84" 84"	18" 18"	7' 8'	5760-8418-7 5760-8418-8	A-5760-8418-7 A-5760-8418-8	84" 84"	36" 36"	7′ 8′	5761-8436-7 5761-8436-8	A-5761-8436-7 A-5761-8436-8
96"	18" 18"	7' 8'	5760-9618-7 5760-9618-8	A-5760-9618-7 A-5760-9618-8	96" 96"	36" 36"	7' 8'	5761-9636-7 5761-9636-8	A-5761-9636-7 A-5761-9636-8



ERECTOMATIC CANTILEVER SHELVING COMPONENTS

COMPONENT IDENTIFIER Cantilever shelving components are identified below as to location in an assembled unit, nomenclature and part number. Complete descriptions and dimensional data appear in the pages which follow.





Description	Part No.
H-Posts Combination Clip Standard Shelves (not shown) Shelf Clip Back Sway Brace (Standard) (not shown) Back Sway Brace (Widespan) Widespan Shelves Double Base	5003 5027 5130 5133 5342 5343 5700 5701
1 2 3 1 5 6 7 8	Combination Clip Standard Shelves (not shown) Shelf Clip Back Sway Brace (Standard) (not shown) Back Sway Brace (Widespan) Widespan Shelves Double Base

Key	Description	Part No.
10	Post Web	5703
11	Arm Clip	5704
12	Shelf Arm	5705
13	Utility Rod and End Cap Kit	5707
14	Utility Rod	5708
15	Sway Brace (Double Face Unit)	5709
16	Base Strip	5710
	Base Shim	5711
17 18	Plywood Shelf Adapter	5712



#### ERECTOMATIC CANTILEVER SHELVING COMPONENTS

Description Part Number Width Depth Height

1. H-POSTS. Heavy duty posts. Two H-Posts bolted together with a post web (Part No. 5703) form the uprights required for cantilever shelving. Posts are pierced on 1-1/2" centers for independent shelf arm adjustment.

1-1/2"	2-5/16"	7'3"	5003-7	
1-1/2"	2-5/16"	8'3"	5003-8	
1-1/2"	2-5/16"	10'3"	5003-10	



2. H-POST COMBINATION CLIP. Zinc plated clip. Attaches to H-Post uprights to provide mounting surface required for back sway braces. Used for single faced cantilever models. Pat. Pend.

-	-	-	5027

3. STANDARD SHELVES (Class 0). 18 gauge

cold rolled steel. Front and rear edges have triple formed flanges with box flanges on sides. All corners are lapped and welded for maximum strength. Refer to page 63 for cantilever shelf loading information.

36" 36"	18" 24"	-	5130-3618 5130-3624	
36"	30"	-	5130-3630	
42"	18"	-	5130-4218	_
42"	24"	-	5130-4224	
42"	30"	-	5130-4230	
48"	18"	-	5130-4818	_
48"	24"	-	5130-4824	
48"	30"	-	5130-4830	



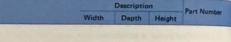
4. SHELF CLIP. One-piece compression clip, zinc plated. Fits snugly against side of post to

		For use with standard 4 required per shelf.		
-	-	-	5133	



5. BACK SWAY BRACES (Standard). For single faced models. Use one set of braces for 7'3" and 8'3" high models; two sets of braces for 10'3" high models. Require use of combination clips for mounting to H-Post uprights. Order 4 combination clips (Part No. 5027) per set of braces.

For 36" Shelf Width	5342-38
For 42" Shelf Width	5342-44
For 48" Shelf Width	5342-55





6. BACK SWAY BRACES (WIDESPAN SHELVES). For single faced models. Set consists of 4 braces and 1 tension disc. Require use of combination clips (Part No. 5027) for mounting to H-Post uprights. Order 4 combination clips per set of braces. Use one set of braces for 7'3" and 8'3" high models: two sets of braces for 10'3" high models, Pat. Pent.

For 72" Shelf Width	5343-6
For 84" Shelf Width	5343-7
For 96" Shelf Width	5343-8

7. WIDESPAN SHELVES. (U.S. Patent No. 3,556,309). 72", 84", and 96" widths; depths of 18", 24", and 30". Refer to page 63 for cantilever shelf loading information.

72"	18"	-	5700-7218
72"	24"	-	5700-7224
72"	30"	-	5700-7230
84"	18"	-	5700-8418
84"	24"	-	5700-8424
84"	30"	-	5700-8430
96"	18"	-	5700-9618
96"	24"	-	5700-9624
96"	30"	-	5700-9630



8. DOUBLE BASE. For double faced shelving models. 14 gauge steel. One-piece allwelded construction. Holes provided for anchoring to floor. Depth of base used must conform to maximum depth of shelves in model. Necessary hardware to mount post assembly furnished with post web (Part No. 57031

For 18" Shelf Depth	5701-18
For 24" Shelf Depth	5701-24
For 30" Shelf Depth	5701-30



9. SINGLE BASE. For single faced shelving models. 14 gauge steel, one-piece, all-welded construction. Holes provided for anchoring to floor. Depth of base must conform to maximum depth of shelves in model. Necessary hardware to mount post assembly fur nished with post web (Part No. 5703).

For 18" Shelf Depth	5702-18
For 24" Shelf Depth	5702-24
For 30" Shelf Depth	5702-30



#### **ERECTOMATIC CANTILEVER** SHELVING COMPONENTS

Description Part Number Width Depth Height 10. POST WEB. Heavy gauge steel plates which bolt between H-Post uprights in single and double faced models. Two H-Post uprights (Part No. 5003) are required per post

assembly and must be ordered separately. For 7'3" Post Height For 8'3" Post Height For 10'3" Post Height

5703-7 5703-8 5703-10

11. ARM CLIP. One-piece, 14-gauge clip enables adjustment of shelf arm without tools. Design assures positive locking of arm in position. Cannot be accidentally dislodged. One clip required for each arm ordered.

5704



12. SHELF ARM, All-welded construction. Adjustable on 1-1/2" centers on uprights to provide desired shelf heights. One arm clip required per arm (Part No. 5704).

> For 18" Shelf Depth 5705-18 5705-24 For 24" Shelf Depth For 30" Shelf Depth 5705-30



13. UTILITY ROD BRACKET AND END

CAP KIT. Bracket mounts to shelf arm (Part No. 5705). End caps provide stop at each end of the rod. In continuous shelving rows, the extra end cap provides an end stop for the last rod.

5707



14. UTILITY ROD. For individual or continuous shelving models. Bracket mounts to shelf arm (Part No. 5705) with utility rod to span the desired shelf width. For garments, reels, spooled materials. Can also be supplied in 36", 42", and 48" widths for use with standard shelves.

5708-6 For 72" Shelf Width 5708-7 For 84" Shelf Width 5708-8 For 96" Shelf Width



Description Part Number Depth Height

15. SWAY BRACE FOR DOUBLE FACED MODELS. Heavy gauge construction. Bolts between uprights with 4 diagonal anti-sway struts attached to face of uprights. Bolts through adjacent shelf arms fixed approximately in the center of the uprights. Use one brace for 7'3" and 8'3" high models; two braces on 10'3" high models.

For 36" Shelf Width	5709-36
For 42" Shelf Width	5709-42
For 48" Shelf Width	5709-48
For 72" Shelf Width	5709-72
For 84" Shelf Width	5709-84
For 96" Shelf Width	5709-96



16. BASE STRIP. Attaches to front of model base closing area between bottom shelf and floor. Provides neat, clean appearance.

1
5710-36
5710-42
5710-48
5710-72
5710-84
5710-96



17. BASE SHIM. Used under shelving base (Part No. 5701 or 5702) for leveling shelving model.

		-	671
300	-	-	02.4



18. PLYWOOD SHELF ADAPTER. 14 gauge steel HAT section with step to accept 3/4" plywood as a light duty shelving surface.

_	18"	-	5712-18
	24"	-	5712-24
400	30"	-	5712-30









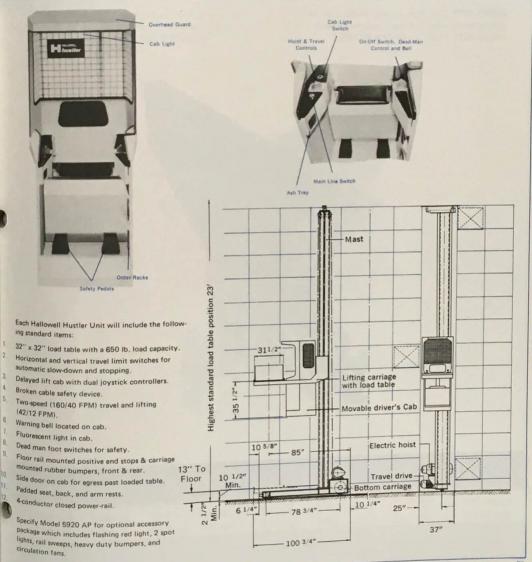
#### MAXIMUM STORAGE EFFICIENCY AND ECONOMY

Hallowell capabilities in high density and multi-level storage systems have now been extended into true high-rise (to 40') storage where very large savings, as much as 60% or more in floor space alone, can be obtained. Decking and stairs have been eliminated to permit maximum use of overhead space for storage. Easy, hand-loading access to all storage compartments from floor to ceiling is achieved by means of a travelling order picker called the Hallowell Hustler.

This captive aisle unit, which enables maximum input-output cycling of stored materials, operates on a fixed rail and requires only a 37" wide aisle. It is capable of horizontal travel speeds up to 320' per min. Vertical travel speeds up to 48' per min. Horizontal and vertical travel can be achieved simultaneously. A single operator controls all movement from the cab, using simple controls and switches. Operating and maintenance costs are low. You save space. You save time. Fewer people can handle more orders with fewer errors, at a lower cost-per-pick.

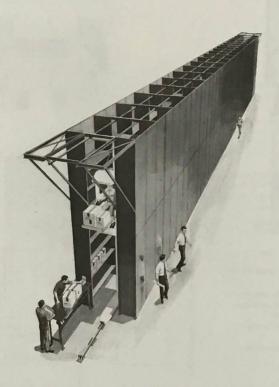


### ALLOWELL HUSTLER ORDER PICKER — MODEL D650 STANDARD FEATURES, DIMENSIONS, AND SPECIFICATIONS.





MODEL 5910 20'6" high with 40 shelving units, 72" wide in the shelf depths shown. Includes standard HALLOWELL HUSTLER ORDER PICKER.\*

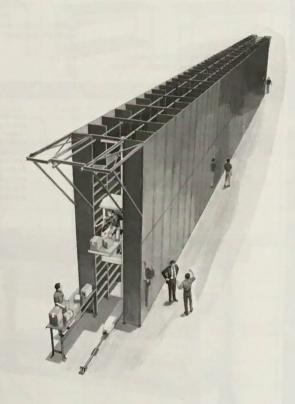


Model No.	Shelf	Shelf Shelf Total Load Table			Travel Speed (FPM)			
	Width	Depth	Total Load Table Height Height	Size of Installation	Storage Space Cubic Feet	Horizontal	Vertical	
5910-7218-20 5910-7224-20	72" 72"	18" 24"	20'6"	15'8"	130' x 6'2"	6,120 8,160	160/40 160/40	48/12 48/12

Specify Model 5920 AP for accessory package which includes flashing red light, 2 spot lights, rail sweeps, heavy duty bumpers, and circulation fan.



MODEL 5900 20'6" high with 80 shelving units, 36" wide in the shelf depths shown. Includes standard HALLOWELL HUSTLER ORDER PICKER.\*



				Maximum	NEW SALES		Travel Speed (FPM)	
Model No.	Shelf	Shelf Depth	Total Height	Load Table Height	Size of Installation	Storage Space Cubic Feet	Horizontal	Vertical
	Width		20'6"	15'8"	130' × 6'2"	6,120	160/40	48/12
5900-3618-20 5900-3624-20	36"	18"	20'6"	15'8"	130' x 7'2"	8,160	160/40	48/12

Specify Model 5920 AP for accessory package which includes flashing red light, 2 spot lights, rail sweeps, heavy duty bumpers, and circulation fan.



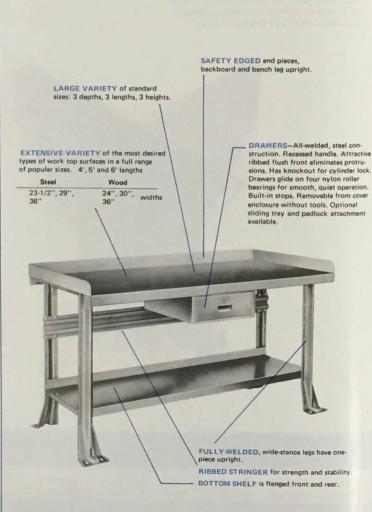
**OPEN WORK STATIONS** 

FEATURES Versatility, strength, and utility are combined in the rugged, clean lines of Hallowell open work benches. Standard parts for specialty functions. Can be speedily assembled to meet the specific requirements of one workman or an entire shop.











# **OPEN WORK STATIONS**



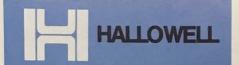






1779		MODEL 600	MODEL 601	MODEL 602	MODEL 604
TO Length of Bench		Consists of: one 6000 top, two 6005 legs, one 6010 stringer	Consists of Model 600 plus: one 6027 lower shelf	Consists of Model 601 plus: one 6016 backboard, one pair 6020 end pcs. (for steel top) or one pair 6022 end pcs. for Hard- board, Halco and Hardwood tops).	Consists of Model 602 plus: one 6320 bench drawer, one 6321 dwr. mtg. kit (for steel and Hard board tops) or one 6322 drw. mtg. kit (for Halco and Hardwood tops).
		Steel Top	Steel Top	Steel Top	Steel Top
4' 5' 6'	24"	600-S-424-33* 600-S-524-33 600-S-624-33	601-S-424-33 601-S-524-33 601-S-624-33	602-S-424-33 602-S-524-33 602-S-624-33	604-S-424-33 604-S-524-33 604-S-624-33
4' 5' 6'	30"	600-S-429-33 600-S-529-33 600-S-629-33	601-S-429-33 601-S-529-33 601-S-629-33	602-S-429-33 602-S-529-33 602-S-629-33	604-S-429-33 604-S-529-33 604-S-629-33
4' 5' 6'	36"	600-S-436-33 600-S-536-33 600-S-636-33	601-S-436-33 601-S-536-33 601-S-636-33	602-S-436-33 602-S-536-33 602-S-636-33	604-S-436-33 604-S-536-33 604-S-636-33
		Hardboard Over Steel Top	Hardboard Over Steel Top	Hardboard Over Steel Top	Hardboard Over Steel Top
4' 5' 6'	24"	600-M-424-33* 600-M-524-33 600-M-624-33	601-M-424-33 601-M-524-33 601-M-624-33	602-M-424-33 602-M-524-33 602-M-624-33	604-M-424-33 604-M-524-33 604-M-624-33
4' 5' 6'	4' 5' 30"	600-M-429-33 600-M-529-33	600-M-536-33 601-M-529-33 601-M-629-33	602-M-429-33 602-M-529-33 602-M-629-33	604-M-429-33 604-M-529-33 604-M-629-33
4' 5' 6'	36"	600-M-629-33 600-M-436-33 601-M-429-33	601-M-436-33 601-M-536-33 601-M-636-33	602-M-436-33 602-M-536-33 602-M-636-33	604-M-436-33 604-M-536-33 604-M-636-33
-	600-M-636-33	Halco-Top	Halco-Top	Halco-Top 604-H-424-33	
4' 5' 6'	24"	Halco-Top 600-H-424-33* 600-H-524-33	601-H-424-33 601-H-524-33 601-H-624-33	602-H-424-33 602-H-524-33 602-H-624-33	604-H-624-33 604-H-624-33 604-H-624-33
4' 5' 6'		600-H-624-33 600-H-430-33 600-H-530-33	601-H-430-33 601-H-530-33 601-H-630-33	602-H-430-33 602-H-530-33 602-H-630-33	604-H-430-33 604-H-630-33 604-H-436-33
4' 5'	36"	600-H-630-33 600-H-436-33 600-H-536-33	601-H-436-33 601-H-536-33 601-H-636-33	602-H-436-33 602-H-536-33 602-H-636-33	604-H-536-33 604-H-636-33
6'		600-H-636-33		Hardwood Top	Hardwood Top
4' 5'	24"	Hardwood Top Hardwood Top 601-W-424-33* 601-W-524-33		602-W-424-33 602-W-524-33 602-W-624-33	604-W-424-33 604-W-524-33 604-W-624-33
6'		600-W-524-33 600-W-624-33 600-W-430-33	601-W-624-33 601-W-430-33 601-W-530-33	602-W-430-33 602-W-530-33 602-W-630-33	604-W-430-33 604-W-530-33 604-W-630-33
6'	36"	600-W-530-33 600-W-630-33 600-W-436-33 600-W-536-33	601-W-630-33 601-W-436-33 601-W-536-33 601-W-636-33	602-W-436-33 602-W-536-33 602-W-636-33	604-W-436-33 604-W-536-33 604-W-636-33

<sup>\*</sup> WORKING HEIGHT: 33 designates working height of bench, See chart on page 78 for complete dimensions



#### **OPEN WORK STATIONS**



ТО	
Length	
Bench	of Top

#### MODEL 605

Consists of: Model 604 plus: one 6024 top shelf.

Steel Top

4' 5' 6'	24"	605-S-424-33 605-S-524-33 605-S-624-33	
4' 5' 6'	30"	605-S-429-33 605-S-529-33 605-S-629-33	
4' 5' 6'	36"	605-S-436-33 605-S-536-33 605-S-636-33	
		Hardboard Over Steel Top	
4' 5' 6'	24"	605-M-424-33 605-M-524-33 605-M-624-33	
4' 5' 6'	30"	605-M-429-33 605-M-529-33 605-M-629-33	
4' 5' 6'	36"	605-M-436-33 605-M-536-33 605-M-636-33	
		Halco-Top	
4' 5' 6'	24"	605-H-424-33 605-H-524-33 605-H-624-33	
4' 5' 6'	30"	605-H-430-33 605-H-530-33 605-H-630-33	
4' 5' 6'	36"	605-H-436-33 605-H-536-33 605-H-636-33	
		Hardwood Top	
4' 5' 6'	24"	605-W-424-33 605-W-524-33 605-W-624-33	
4' 5' 6'	30"	605-W-430-33 605-W-530-33 605-W-630-33	

605-W-436-33

605-W-536-33 605-W-636-33

#### PORTABLE WORK BENCHES

A means of easily transporting a heavy-duty work station directly to job site. Adaptable for use with vises, grinders and other tools. Lower shelf provides additional storage capacity for transporting parts and equipment.





#### MODEL 607 SP

Has steel top, 5' x 29"; backboard, end pieces and lower shelf. Working height is 33-5/8". 4" rubber or steel casters. Handles drop out of way when not in use.

#### MODEL 608 P

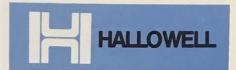
Has steel top, 5' x 29"; lower shelf. Working height is 34-1/8". 4" diameter swivel casters have rubber or steel tread.

With Rubber	With Steel	With Rubber	With Steel
Tread Casters	Tread Casters	Tread Casters	Tread Casters
607-SP-R	607-SP-S	608-P-R	608-P-S

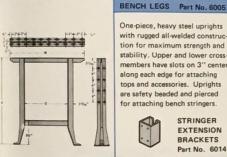
#### DIMENSIONS OF HALLOWELL OPEN BENCHES

Top Material	Lengths	Depths	Working Heights		
			With 29" High Legs	With 31-1/4" High Legs	With 33-1/2" High Legs
Steel "S"	4' 5' 6'	23-1/2", 29", 36"	29-1/8"	31-3/8"	33-5/8"
Hardboard "M" Over Steel	4' 5' 6'	23-1/2", 29", 36"	31-3/16"	33-7/16"	35-11/16"
Halco-Top "H" Hardwood "W"	4' 5' 6'	24", 30", 36"	30-3/4"	33"	35-1/4"

5' 36"



#### **OPEN WORK STATIONS** PARTS AND ACCESSORIES



One-piece, heavy steel uprights with rugged all-welded construction for maximum strength and stability. Upper and lower crossmembers have slots on 3" centers along each edge for attaching tops and accessories. Uprights are safety beaded and pierced for attaching bench stringers.



STRINGER **EXTENSION** BRACKETS Part No. 6014

Moves stringer away from legs to provide clearance for mounting tiers of drawers in 24" deep open benches. Supplied in sets of two

ELG DIMEROIONS			CHULINOI	Fatt Number		
	Height	Depth of Top Brace "W"	Width of Bottom Brace "O"	Steel	Wood	
	-	22%"	13¼"	23%"	24"	6005-2923
	29"	28%"	16%"	29"	30"	6005-2928
	-	34%"	22¼"	36"	36"	6005-2934
1	-	22%"	13%"	23%"	24"	6005-3123
١	31¼"	28%"	16%"	29"	30"	6005-3128
	_	34%"	22¼"	36"	36"	6005-3134
	-	22%"	13¼"	23%"	24"	6005-3323
	33%"	28%"	16%"	29"	30"	6005-3328
1		34½"	22¼"	36"	36"	6005-3334
	-	22%"	13¼"	23%"	24"	6005-3623
	36"	28½"	16%"	29"	30"	6005-3628

36"

47%"

59%"

71%"

Length

4'

5'

6

For Bench Depth

30"

For Bench Depth

23% or

24

29 or

30"

2214"

LEG DIMENSIONS

34%"



BENCH STRINGER Part No. 6010 4-3/4" wide ribbed section is bolted to bench legs to provide rigidity

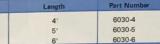
of bench. One required per bench.



LOWER SHELF Part No. 6027 Attaches to lower cross-member of bench leg to provide convenient storage space. Has 1%" flanged front and back for strength. Pierced for easy assembly. 12-7/8" deep for all benches.



FOOTREST Part No. 6030 Attaches to lower cross members of bench legs. Strong box channel design.



Caster

Tread Rubber

Steel

Steel

Caster

Rubber

Steel

Steel

Rubber

Rubber

36"

For

4'

5'

Bench Le

6005-3634

Part Number

6010-4

6010-5

6010-6

6027-4

6027-5

6027-6

Part Number

6050-24R

6050-245

6050-30R

6050-305

Part Numbe

6051-24R

6051-24S

6051-30R

6051-30S

Part Number



SEMI-PORTABLE ADAPTER KIT Part No. 6050 Used with standard open bench parts to build semi-portable work 23% or 24" station. Kit includes: 28 or

2-4" diameter casters

1-Lower shelf adapter 1-Set of drop handles



PORTABLE ADAPTER KIT Part No. 6051 Converts open bench to portable work station. Overall heights of kit with brackets is 5". Kit includes:

4-4" diameter swivel casters

2-Caster plates

Other Accessories Available (See page 90)









#### **CABINET WORK STATIONS**

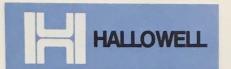
FEATURES A spacious work surface combined with an enclosed storage space for the security of materials and tools. Neat, modern appearance. Heavy gauge steel construction.





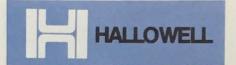






# **CABINET WORK STATIONS**

200		MODEL 620	MODEL 621	MODEL 622	MODEL 623	
	Depth	Consists of: one 6207 basic cabinet, one 6000 top.	Consists of Model 620 plus: one 6212 cabinet shelf.	Consists of Model 621 plus: one 6208 sliding doors.	Consists of Model 622 plus: four 6320 drawers, two 6323 stacking kits, and two 6321 of 6322 drawer mtg. kits	
h	Тор			Steel Top	Steel Top	
5' B'		Steel Top 620-S-424	Steel Top 621-S-424 621-S-524	622-S-424 622-S-524 622-S-624	623-S-424 623-S-524 623-S-624	
	24"	620-S-524 620-S-624	621-S-624	622-S-429	623-S-429 623-S-529	
	30"	620-S-429 620-S-529	621-S-429 621-S-529 621-S-629	622-S-629 622-S-629	623-S-629 Hardboard Over Steel Top	
-		620-S-629	Hardboard Over Steel Top	Hardboard Over Steel Top 622-M-424	623-M-424	
4		Hardboard Over Steel Top 620-M-424	621-M-424 621-M-524	622-M-524 622-M-624	623-M-524 623-M-624	
	24"	620-M-524 620-M-624	621-M-624	622-M-429 622-M-529	623-M-429 623-M-529 623-M-629	
*	30"	620-M-429 620-M-529	621-M-429 621-M-529 621-M-629	622-M-629	Halco-Top	
× .		620-M-629		Halco-Top	623-H-424	
-		Halco-Top	Halco-Top 621-H-424	622-H-424 622-H-524	623-H-524 623-H-624	
4' 5'	24"	620-H-424 620-H-524 620-H-624	621-H-524 621-H-624	622-H-624	623-H-430 623-H-530 623-H-630	
4'		620-H-430	621-H-430 621-H-530	622-H-530 622-H-630	Hardwood Top	
5' 6'	30"	620-H-530	621-H-630	Hardwood Top	623.W-424	
-	-	620-H-630	Hardwood Top	622.W-424	623-W-524 623-W-624	
4	1	Hardwood Top 620-W-424	621-W-424	622-W-524 622-W-624	623-W-430	
6'	24"	620-W-424 620-W-524 620-W-624	621-W-524 621-W-624	622-W-430 622-W-530	623-W-530 623-W-630	
4' 5' 6'	30"	620-W-430	621-W-430 621-W-530 621-W-630 1/2"; Hardboard over Steel, 35-11/	622-W-630		



**CABINET WORK STATIONS** 







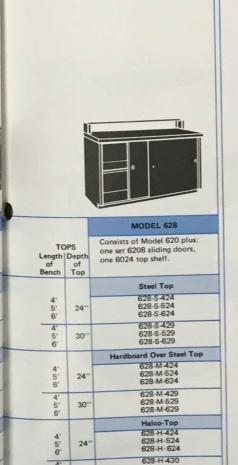


	_					
		MODEL 624	MODEL 625	MODEL 626	MODEL 627	
TO Length of Bench		Consists of Model 623 plus: 2 additional 6320 drawers.	Consists of Model 623 plus: 4 additional 6320 drawers.	Consists of Model 620 plus: 1 additional 6212 cabinet shelf.	Consists of Model 626 plu two 6320 drawers, two 63 drawers or 6322 mtg. kits.	
		Steel Top	Steel Top	Steel Top	Steel Top	
4' 5' 6'	24"	624-S-424 624-S-524 624-S-624	625-S-424 625-S-524 625-S-624	626-S-424 626-S-524 626-S-624	627-S-424 627-S-524	
4' 5' 6'	30"	624-S-429 624-S-529 624-S-629	625-S-429 625-S-529 625-S-629	626-S-429 626-S-529 626-S-629	627-S-624 627-S-429 627-S-529 627-S-629	
		Hardboard Over Steel Top	Hardboard Over Steel Top	Hardboard Over Steel Top	Hardboard Over Steel Top	
4' 5' 6'	24"	624-M-424 624-M-524 624-M-624	625-M-424 625-M-524 625-M-624	626-M-424 626-M-524 626-M-624	627-M-424 627-M-524	
4' 5' 6'	30"	624-M-429 624-M-529 624-M-629	625-M-429 625-M-529 625-M-629	626-M-429 626-M-529 626-M-629	627-M-624 627-M-429 627-M-529	
		Halco-Top	Halco-Top	Halco-Top	627-M-629 Halco-Top	
4' 5' 6'	24"	624-H-424 624-H-524 624-H-624	625-H-424 625-H-524 625-H-624	626-H-424 626-H-524 626-H-624	627-H-424 627-H-524	
5' 6'	30"	624-H-430 624-H-530 624-H-630	625-H-430 625-H-530 625-H-630	626-H-430 626-H-530 626-H-630	627-H-624 627-H-430 627-H-530	
		Hardwood Top	Hardwood Top	Hardwood Top	627-H-630	
4' 5' 6'	24"	624-W-424 624-W-524 624-W-624	625-W-424 625-W-524 625-W-624	626-W-424 626-W-524 626-W-624	627-W-424 627-W-524	
4' 5' 6'	30"	624-W-430 624-W-530 624-W-630	625-W-430 625-W-530 625-W-630	626-W-624 626-W-430 626-W-530 626-W-630	627-W-624 627-W-430 627-W-530 627-W-630	

NOTE: Working Heights: with Steel Top, 35-1/2"; Hardboard over Steel, 35-11/16"; Halco Top or Hardwood, 35-1/4".



# CABINET WORK STATIONS PARTS AND ACCESSORIES



628-H-530 628-H-630

Hardwood Top 628-W-424

628-W-524

628-W-624

628-W-430

628-W-530

628-W-630

4

5

6

4

5

6

4

5

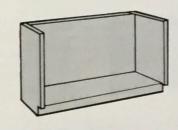
6

30"

24

30"

#### BASIC CABINET BENCH Part No. 6207



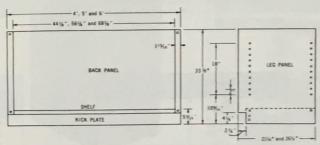
Includes:

2 Leg Panels

1 Back Panel

1 Shelf 1 Kick Plate

Order top separately. See page 89.

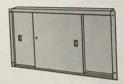


For Use With Top Size			
Length	Depth	Part Number	
4'	23-1/2"	6207-424	
5'	or	6207-524	
6'	24"	6207-624	
4'	29"	6207-430	
5'	or	6207-530	
6'	30"	6207-630	



# CABINET WORK STATIONS PARTS AND ACCESSORIES

#### CABINET BENCH SLIDING DOORS Part No. 6208



Glide smoothly on inverted "V" tracks with nylon rollers and guides. Built-in cylinder lock. Opening 27" high.

NOTE: Drawers can be used only in the 30" deep bench when sliding-doors are used. Part No. 6324 mounting kit is required in addition to Part No. 6321 or 6322.

For Bench Length	Open Width Each Door	Part Number
4'	20-3/8"	6208-4
5'	26-3/8"	6208-5
6'	32-3/8"	6208-6

#### **CABINET BENCH SHELF Part No. 6212**



Heavy gauge steel, 1-13/16" box-flanged front and rear, 18-3/8" deep for 24" benches. 23-7/8" for 30" benches.

For Bench			
Length	Depth	Part Number	
4'		6212-424	
5'	24"	6212-524	
6'		6212-624	
4'		6212-430	
5'	30"	6212-530	
6'		6212-630	

Other Accessories Available (See page 90)

















**FEATURES** Functionally designed. Smart in appearance. Rugged. Ideal for precise work and specialized storage.

#### UNIT WORK STATIONS





# **UNIT WORK STATIONS**



MODEL 640



MODEL 641



MODEL 642

642-W-630-33

TO Length of Bench	PS Depth of Top	Consists of: one 6000 top, one 6402 drawer pedestal, one 6404 cabinet pedestal, one pair 6408 base, one pair 6001 channels for steel top	Consists of Model 640 plus: one 6016 backboard, one pair 6020 or 6022 end pieces	Consists of Model 640 plus: one 6024 top shelf
		Steel Top	Steel Top	Steel Top
5'	24" 30"	640-S-524-33* 640-S-529-33	641-S-524-33 641-S-529-33	642-S-524-33 642-S-529-33
6'	24" 30"	640-S-624-33 640-S-629-33	641-S-624-33 641-S-629-33	642-S-624-33 642-S-629-33
		Hardboard Over Steel Top	Hardboard Over Steel Top	Hardboard Over Steel Top
5'	24" 30"	640-M-524-33* 640-M-529-33	641-M-524-33 641-M-529-33	642-M-524-33 642-M-529-33
6'	24" 30"	640-M-624-33 640-M-629-33	641-M-624-33 641-M-629-33	642-M-624-33 642-M-629-33
		Halco-Top	Halco-Top	Halco-Top
5'	24" 30"	640-H-524-33* 640-H-530-33	641-H-524-33 641-H-530-33	642-H-524-33 642-H-530-33
6'	30"	640-H-624-33 640-H-630-33	641-H-624-33 641-H-630-33	642-H-624-33 642-H-630-33
		Hardwood Top	Hardwood Top	Hardwood Top
5'	30"	640-W-524-33* 640-W-530-33	641-W-524-33 641-W-530-33	642-W-524-33 642-W-530-33
6'	24" 30"	640-W-624-33 640-W-630-33	641-W-624-33 641-W-630-33	642-W-624-33

\*WORKING HEIGHT - 33 designates height of bench. Specify as per table below.

	-31	-33	-35
Depth	Actual Working Ht. Without Base	Actual Working Ht.	Actual Working Ht.
23-1/2", 29"		AND DESCRIPTION OF THE PARTY OF	With 4-1/2" Base
			35-1/2"
		33-7/16"	35-11/16
24", 30"	30-3/4"	33"	35-1/4"
24", 30"	30-3/4"		35-1/4"
	23-1/2", 29" 23-1/2", 29" 24", 30"	Depth Actual Working Ht. Without Base 23-1/2", 29" 31" 23-1/2", 29" 31-3/16" 24", 30" 30-3/4"	Depth Actual Working Ht. Without Base 23-1/2", 29" 31" 33-1/4" 33-1/4" 23-1/2", 29" 31-3/16" 33-7/16" 24", 30" 30-3/4" 33"

641-W-630-33



# UNIT WORK STATIONS









		MODEL 643	MODEL 646	MODEL 648	MODEL 649
of	PS Depth of Bench	Consists of: one 6000 top, two 6402 drawer pedestals, 1 pr. 6408 bases, 1 pr. 6001 channels for steel top.	Consists of: one 6000 top, two 6404 cabinet pedestals, 1 pr. 6408 bases, 1 pr. 6001 channels for steel top	Consists of: one 6000 top, one 6404 cabinet pedestal, one 6412 panel leg, 1 pr. 6001 channels for steel top	Consists of: one 6000 top, one 6402 drawer pedestal, one 6412 panel leg, 1 pr. 6001 channels for steel top.
Delici	Delicii	O. J.Tan	Steel Top	Steel Top	Steel Top
5'	24"	Steel Top 643-S-524-33*	646-S-524-33 646-S-529-33	648-S-524-33 648-S-529-33	649-S-524-33 649-S-529-33
6'	30" 643-S-529-33 643-S-624-33		646-S-624-33 646-S-629-33	648-S-624-33 648-S-629-33	649-S-624-33 649-S-629-33
	30"	643-S-629-33	Hardboard Over Steel Top	Hardboard Over Steel Top	Hardboard Over Steel Top
5'	24"		646-M-524-33 646-M-529-33	648-M-524-33 648-M-529-33	649-M-524-33 649-M-529-33
6'	30"		646-M-624-33 646-M-629-33	648-M-624-33 648-M-629-33	649-M-629-33
	30"	643-M-629-33 Halco-Top	Halco-Top	Halco-Top	Halco-Top
5'	24'	643-H-524-33*	646-H-524-33 646-H-530-33	648-H-524-33 648-H-530-33	649-H-524-33 649-H-530-33
- 6'	30'	643-H-624-33	646-H-624-33 646-H-630-33	648-H-624-33 648-H-630 <sub>4</sub> 33	649-H-624-33 649-H-630-33
	30'		Hardwood Top	Hardwood Top	Hardwood Top
5'	24		646-W-524-33 646-W-530-33	648-W-524-33 648-W-530-33	649-W-524-33 649-W-530-33
- 6'	30	" 643-W-624-33	646-W-624-33 646-W-630-33	648-W-630-33 648-W-630-33	649-W-624-33 649-W-630-33

- 33 designates height of bench. Specify as per table below.

*WORKING HEIGHT = 33 doss		-31	-33	-35
Top Material	Depth	Actual Working Ht. Without Base	Actual Working Ht. With 2-1/4" Base	Actual Working Ht. With 4-1/2" Base
Top Material	22 1/2" 20"	31"	33-1/4"	35-1/2"
Steel	23-1/2", 29"	31-3/16"	33-7/16"	35-11/16"
Hardboard Over Steel		30-3/4"	33"	35-1/4"
1-3/4" Hardwood 1-3/4" Halco-Top	24", 30"	30-3/4"	33"	35-1/4"



# UNIT WORK STATIONS PARTS AND ACCESSORIES

			Dimensio	ns	
Model	Description		Depth	Height	Part Number
	UNIT BENCH PEDESTAL BASES  Heavy duty boxed construction. Embossed top and bottom for flush mounting of pedestals and to prevent damage to floor. Flush front or optional recessed toe base.	16" 16" 16"	21-1/2" 21-1/2" 18-3/4" 18-3/4"	4-1/2" 2-1/4"	Flush Front Base 6408-2 6408-4 Optional Recessed Toe Base 6409-2 6409-4
	UNIT BENCH PANEL LEG Available in three heights, For unit benches where only one drawer or cabinet pedestal is required. Can be used either right or left-hand side.	3"	21-1/2" 21-1/2" 21-1/2"	31-1/4"	6412-29 6412-31 6412-33
	UNIT BENCH DRAWER PEDESTAL  All-welded construction completely assemble enclosed front, top, sides and back. Not a star individual drawer units. This is a sturdy, attra with drawers that operate smoothly and quie nylon roller bearings. Drawers have flush pull fronts and knockouts for cylinder locks (opti No. 6300). Outside cabinet size: 16" wide, 25 and 21-1/2" deep. Inside drawer size: 14" with high and 19-7/8" deep.	ck of active cab tly on s, ribbed onal: Par 9" high			6402
	UNIT BENCH CABINET  All-welded, completely assembled cabinet wit front, top, sides and back. Has one shelf adjur 2" centers. Reversible door can be mounted releft hand and has chrome plated locking hand with two keys, Outside cabinet size: 16" widhigh and 21-1/2" deep. Clear door opening: 1 wide, 22-7/16" high.	stable on ight or lle e, 29"			6404







# UNIT WORK STATIONS PARTS AND ACCESSORIES

Model	Description  STEEL TOP  Heavy gauge to withstand rough use. Smooth, durable work surface. Overall height of 2" with 1" bottom return flange. Converts to use on cabinet and unit work benches by the	Length of Top 4' 5' 6'	Depth of Top	Part Number 6000-S-424
	Heavy gauge to withstand rough use, Smooth, durable work surface. Overall height of 2" with 1" bottom return flange. Converts to use on cabinet and unit work benches by the	4' 5'		6000-S-424
-	Heavy gauge to withstand rough use, Smooth, durable work surface. Overall height of 2" with 1" bottom return flange. Converts to use on cabinet and unit work benches by the	5'	23-1/2"	0000-3-424
1	durable work surface. Overall height of 2" with 1" bottom return flange. Converts to use on cabinet and unit work benches by the		23-1/2	6000-S-524
1	with 1" bottom return flange. Converts to use on cabinet and unit work benches by the	ь		6000-S-624
1	on cabinet and unit work benches by the			0000-3-024
		4'		6000-S-429
	addition of top channels:	5'	29"	6000-S-529
	Part No. 6001-24 for 23-1/2" top depth,	6'	25	6000-S-629
	Part No. 6001-29 for 29" top depth.	0		000000
	For cabinet bench top conversion, order one			
	pair; for unit bench, two pairs.	4'		6000-S-436
		5'	36"	6000-S-536
		6'		6000-S-636
	HALLOWELL HALCO-TOP	4'	7 7 7	6000-H-424
	Wear-resistant facings of wood fibers and resins	5'	24"	6000-H-524
	scientifically combined under heat and pressure.	6'		6000-H-624
	Strong, solid wood composition core. Tan			
A STATE OF THE PARTY OF THE PAR	surface coated to resist oil, grease, chemicals.	-		6000-H-430
	Non-conductive surface. Ideal for use in	4' 5'	30"	6000-H-530
(0)0)	electronic applications. Can be sanded and	6'	30	6000-H-630
	re-finished like natural hardwood. Overall thickness 1-3/4".	0		0000-11-030
	thickness 1-5/4.	4'		6000-H-436
		5'	36"	6000-H-536
		6'	30	6000-H-636
		"		0000111000
	HARDBOARD TOP	4'		6000-M-424
	3/16" tempered hardboard over heavy gauge	5'	23-1/2"	6000-M-524
	steel top. Top is 2-3/16" overall height. To	6'	23-1/2	6000-M-624
	convert for use on unit benches with top			0000 111 02 1
	depth of 23-1/2", order one pair of top	41		6000-M-429
	channels (Part No. 6001-24); for top depth	4' 5'	29"	6000-M-429 6000-M-529
	of 29", one pair Part No. 6001-29.	6'	29	6000-M-629
		0		0000-W-025
		41		6000 14 426
		4' 5'	36"	6000-M-436 6000-M-536
	Control of the second s	6'	30	6000-M-636
		0		3000 111 030
	HARDWOOD TOP	4'		6000-W-424
		5'	24"	6000-W-524
	Vertically laminated strips of natural hardwood electronically bonded for uniform adhesion.	6'	24	6000-W-624
	Edge-grain construction. All surfaces finished	0		0000111024
	with clear shellac or lacquer. Overall thickness	4'		6000-W-430
And the second	1-3/4"	5'	30"	6000-W-530
CONTRACTOR OF THE PARTY OF		6'	30	6000-W-630
LINE WATER				
		4'		6000-W-436
		5'	36"	6000-W-536
		6'		6000-W-636



# **WORK STATION ACCESSORIES**

	0	imension	25	
Part	Len./ Width	Depth	Height	Part Number
L. CALLORINA	4'	_	4-1/4"	6016-4
BACKBOARD Extends above work surface	5'	-	4-1/4"	6016-5
of bench. Top flanged for	6'	-	4-1/4"	6016-6
strength and safety.			ALC: 7	
		For Benc Depth	h	
		23-1/2		6020-24
-		29"		6020-29
END PIECES Extend above work surface		36"		6020-36
of bench. Furnished in	23	-1/2" or	24"	6022-24
pairs, one right hand and one left, Part No. 6020 is		9" or 30		6022-30
for 6000-S steel top on		36"		6022-36
open benches only. Part No. 6022 for all others.		30		6022-36
	Len./ Width	Depth	Height	
		Сорин	Trongitt	
TOP SHELF	4'	10"	12"	6024-4
Keeps equipment and	5'	10"	12"	6024-5
parts off work surface.	6'			
10-3/4" clear height under shelf.	6	10"	12"	6024-6
		For Top		
15 15 15 15 15		Length		
WIREMOLD® SECTION				
Continuous outlet sections				
are underwriters' approved. Equipped with 15A-125V				
black three-prong grounded	1	4'	6025-4	
receptacles. Standard lengths are 1-3/8" longer		5'		6025-5
than tops to accommodate	1	6'	6025-6	
lead-in wiring. Aluminum finish. Last digit of model	Page 1			
number shows number			1	
of outlets.				
	Len./ Width	Depth	Height	
	Triutil	Ceptil	rieight	
7			1	
ELECTRICAL PANEL		100000	The second of	
Mounts on rear of bench	4'	6"	7-11/16"	6040-4
Mounts on rear of bench top. Knockouts for	4' 5'	6" 6"	7-11/16" 7-11/16"	6040-4 6040-5
Mounts on rear of bench top. Knockouts for standard electrical boxes and receptacles. 2 each				
Mounts on rear of bench top. Knockouts for standard electrical boxes and receptacles. 2 each side on 4' models: 4 each	5'	6"	7-11/16"	6040-5
Mounts on rear of bench top. Knockouts for standard electrical boxes and receptacles. 2 each	5'	6"	7-11/16"	6040-5

Part		Dimensio	ns	Part I	Vumber
Fits inst and	LINDER L s bench dra alled. Has is master l s included.	wers. Eas satin finis keyed. Tu	sh	63	00
		Inside Siz	е		_
	Width	Depth	Height		
	12-1/8"	6"	1"	6305-14	14" drawe
SLIDING TRAYS Ideal for storing gages tools, or small parts in drawers.	18-5/8"	6"	1"	6305-20	width 20" drawe width
	1	nside Siz	e		
	14"	19-7/8"	5"		
BENCH DRAWERS	20"	19-7/8"			
Sturdy construction, re- cessed pull, attractive ribbed				6320-1	420
cessed pull, attractive ribbed front with knockout for cylinder locks or padlock hasp. Smooth, quiet nylon roller bearings. Order correct mounting kit below.	Ou	6320-2020			
	15-3/16"	20-5/16	6-3/8"		
1	For	Top Dep	th		
		23-1/2"		6321	
DRAWER MOUNTING KITS FOR STEEL TOPS		29"		6321	
Contains channels and hard- ware for mounting drawer under steel or hardboard covered steel tops.		36"		6321	-30
FOR WOOD TOPS Kit for mounting drawer under Tops or Halco-Tops. Contains 1/4" x 1" slotted hex head scre	four			6322	
FOR STACKING Kit for mounting one drawer u another or for mounting drawe tool stands, etc. Contains four 1/4" x 3/8" bolts with nuts and lockwashers.	r in			6323	

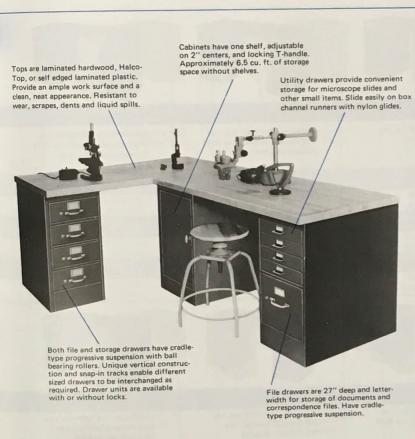


STORAGE WALL UNITS

Use as small parts storage units on top shelf above benches, under or along side benches. See page 98 for further details and models available. FEATURES From a broad selection of tops and storage bases, components can be keyed into virtually any laboratory operation--research, testing, hospitals, schools and libraries. Ideal for use where the work-storage requirements are complex and continually changing.



RESEARCH AND ENGINEERING STATIONS



# R/E STATION DRAWERS.

Drawers, in three sizes, can be set up for files, correspondence, or instrument storage. Finished in ASA No. 49 Gray.



# UTILITY DRAWER.

Size: 15-1/4"W. x 25-5/8"D. x 2-1/4"H. Each drawer has two removable vertical dividers.



# STORAGE DRAWER.

Size: 15-1/4"W. x 17"D. x 4-3/4"H. One-piece construction at sides and bottom provides added strength.



#### FILE DRAWER

Size: 15-1/4"W. x 27"D. x 9-7/8"H. Finger tip controlled. Positive side arm locking compressor. Hand hold in rear for removing and safe handling.









**RESEARCH AND ENGINEERING STATIONS** 

Select the R/E station to suit your needs from the wide variety of standard models shown. Or, custom build to your functional requirements from the standard components shown on pages 94 and 95.







MODEL 720	MODEL 721	MODEL 722
Consists of: one 7000 top, two 7601 cabinet pedestals	Consists of: one 7000 top, one 7601 cabinet pedestal, one 7603 3-drawer pedestal	Consists of: one 7000 top, one 7601 cabinet pedestal, one 7602 2-drawer pedestal
Halco-Top	Halco-Top	Halco-Top
720-H-530 720-H-630	721-H-530 721-H-630	722-H-530 722-H-630
Plastic Top	Plastic Top	Plastic Top
720-SE-530 720-SE-630	721-SE-530 721-SE-630	722-SE-530 722-SE-630
Hardwood Top	Hardwood Top	Hardwood Top
720-W-530 720-W-630	721-W-530 721-W-630	722-W-530 722-W-630
	Consists of: one 7000 top, two 7601 cabinet pedestals  Halco-Top 720-H-530 720-H-630  Plastic Top 720-SE-530 720-SE-630  Hardwood Top 720-W-530	Consists of: one 7000 top, two 7601 cabinet pedestals







	MODEL 723	MODEL 724	MODEL 725
Top Length	Consists of: one 7000 top, one 7601 cabinet pedestal, one 7606 6-drawer pedestal	Consists of: one 7000 top, one 7603 3-drawer pedestal, one 7605 5-drawer pedestal	Consists of: one 7000 top, one 7602 2-drawer pedestal, one 7608 8-drawer pedestal
	Halco-Top	Halco-Top	Halco-Top
5' 6'	723-H-530 723-H-630	724-H-530 724-H-630	725-H-530 725-H-630
	Plastic Top	Plastic Top	Plastic Top
5' 6'	723-SE-530 723-SE-630	724-SE-530 724-SE-630	725-SE-530 725-SE-630
	Hardwood Top	Hardwood Top	Hardwood Top
5' 6'	723-W-530 723-W-630	724-W-530 724-W-630	725-W-530 725-W-630

- NOTES: 1. Models are 29" high plus top thickness: 1-3/4" for Halco-Top, 1-1/4" for plastic, and 1-3/4" for hardwood.
  - 2. Tops are 30" deep by 5" or 6" long.
  - 3. Base units are all-welded steel, manufactured to high quality furniture standards.
  - 4. See pages 94 and 95 for components.



# RESEARCH AND ENGINEERING STATIONS

	व्यक्तिका व		added a la
	MODEL 726	MODEL 727	MODEL 728
Top Length	Consists of: one 7000 top, one 7604 4-drawer pedestal, one 7606 6-drawer pedestal	Consists of: one 7000 top, one 7604 4-drawer pedestal, one 7612 end panel	Consists of: one 7000 top, one 7606 6-drawer pedestal, one 7612 end panel
	Halco-Top	Halco-Top	Halco-Top
5' 6'	726-H-530 726-H-630	727-H-530 727-H-630	728-H-530 728-H-630
	Plastic Top	Plastic Top	Plastic Top
5' 6'	726-SE-530 726-SE-630	727-SE-530 727-SE-630	728-SE-530 728-SE-630
	Hardwood Top	Hardwood Top	Hardwood Top
5' 6'	726-W-530 726-W-630	727-W-530 727-W-630	728-W-530 728-W-630
		E	
	MODEL 729	MODEL 730	MODEL 731
Тор	MODEL 729  Consists of: one 7000 top, one 7605 5-drawer pedestal, one 7612 end panel	MODEL 730  Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7606 6-drawer pedestal	MODEL 731  Consists of: two 7000 tops, one 7602 2-drawer pedestal, two 7606 6-drawer pedestals
Top Length	Consists of: one 7000 top, one 7605 5-drawer pedestal, one 7612 end panel	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7606	Consists of: two 7000 tops, one 7602 2-drawer pedestal, two 7606 6-drawer pedestals Halco-Top
Length 5'	Consists of: one 7000 top, one 7605 5-drawer pedestal, one 7612 end panel  Halco-Top  729-H-530	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7606 6-drawer pedestal	Consists of: two 7000 tops, one 7602 2-drawer pedestal, two 7606 6-drawer pedestals  Halco-Top 731-H-530 731-H-630
Length	Consists of: one 7000 top, one 7605 5-drawer pedestal, one 7612 end panel  Halco-Top  729-H-530 729-H-630	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7606 6-drawer pedestal  Halco-Top 730-H-530	Consists of: two 7000 tops, one 7602 2-drawer pedestal, two 7606 6-drawer pedestals  Halco-Top 731-H-530 731-H 630  Plastic Top
Length 5'	Consists of: one 7000 top, one 7605 5-drawer pedestal, one 7612 end panel  Halco-Top  729-H-530	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7606 6-drawer pedestal  Halco-Top  730-H-530 730-H-630	Consists of: two 7000 tops, one 7602 2-drawer pedestal, two 7606 6-drawer pedestals  Halco-Top 731-H-530 731-H-630  Plastic Top 731-SE-530 731-SE-630
5' 6'	Consists of: one 7000 top, one 7605 5-drawer pedestal, one 7612 end panel  Halco-Top  729-H-530 729-H-630  Plastic Top  729-SE-530	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7606 6-drawer pedestal  Halco-Top  730-H-530 730-H-630  Plastic Top  730-SE-530	Consists of: two 7000 tops, one 7602 2-drawer pedestal, two 7606 6-drawer pedestals  Halco-Top 731-H-530 731-H-630  Plastic Top 731-SE-530

- Tops are 30" deep by 5' or 6' long.
   Base units are all-welded steel, manufactured to high quality furniture standards.
- 4. See pages 94 and 95 for components.



# RESEARCH AND ENGINEERING STATIONS







MODEL 734

	MODEL 732	MODEL 700	
Top Length	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7604 4-drawer pedestal, one 7606 6- drawer pedestal, one 7612 end panel	Consists of: two 7000 tops, one 7601 cabinet pedestal, one 7603 3-drawer pedestal, one 7608 8-drawer pedestal, one 7612 end panel	Consists of: two 7000 tops, one 7602 2-drawer pedestal, one 7604 4-drawer pedestal, one 7605 5-drawer pedestal, one 7612 end panel
	Halco-Top	Halco-Top	Halco-Top
5'	732-H-530	733-H-530	734-H-530
6'	732-H-630	733-H-630	734-H-630
	Plastic Top	Plastic Top	Plastic Top
5'	732-SE-530	733-SE-530	734-SE-530
6'	732-SE-630	733-SE-630	734-SE-630
	Hardwood Top	Hardwood Top	Hardwood Top
5'	732-W-530	733-W-530	734-W-530
6'	732-W-630	733-W-630	734-W-630

NOTES: 1. Models are 29" high plus top thickness: 1-3/4" for Halco-Top, 1-1/4" for plastic, and 1-3/4" for hardwood.

- 2. Tops are 30" deep by 5' or 6' long.
- 3. Base units are all-welded steel, manufactured to high quality furniture standards.

#### R/E STATION COMPONENTS AND ACCESSORIES - TOPS

Three different top materials available: Halco-Top ("H"), Plastic ("SE"), and Hardwood ("W"). All tops are 30'' deep.

NOTE: Because of the many possible pedestal arrangements, tops must be drilled in the field.



Halco-Top ("H")



Plastic Top ("SE")

Laminated plastic top and edges, Color: gray. Underside has moisture resistant "backer" sheet covering.



Hardwood Top ("W")

Dimensions	Dimensions			Dimensions							
Len./ Width	Depth	Height	Part Number	Len./ Width	Depth	Height	Part Number	Len./ Width	Depth	Height	Part Number
5'	30"	1%"	7000-H-530	5'	30"	11/4"	7000-SE-530	5'	30"	1%"	7000-W-530
6'	30"	134"	7000-H-630	6'	30"	11/4"	7000-SE-630	6'	30"	1%"	7000-W-630



# R/E STATION PARTS AND ACCESSORIES

# CABINET AND DRAWER PEDESTALS



CABINET



2-DRAWER PEDESTAL



3-DRAWER PEDESTAL



4-DRAWER PEDESTAL



5-DRAWER PEDESTAL



6-DRAWER PEDESTAL



8-DRAWER PEDESTAL



END PANEL WITH LEGS



SUB-BASE

#### CABINET PEDESTAL No. 7601

All-welded, completely enclosed cabinet with one shelf adjustable on 2" centers. Door hinges on either right or left hand side. Has locking T-handle with two keys. Not master keyed.

# DRAWER PEDESTALS No. 7602 thru 7608

All-welded, heavy duty construction. Drawers have double walls at front, with drawer backs and fronts welded directly to drawer bottom. Sturdy pulls and label holder hardware have aluminum satin finish. Plunger type lock option.

Simultaneously locks all drawers.

#### **END PANELS No. 7612**

Contemporary design with legs of 1-1/4" tubing. Threaded insert assures proper height alignment. Available with or without filler panel.

# SUB-BASE No. 7613

Fits under storage base to increase overall height. Available in two sizes: 2-1/4" for 31-1/4" overall height; 4-1/2" for 33-1/2" overall height.

Width PEDE: 17%" 17%" 17%"	Depth	Height	Description	
17¾" 17¾" 17¾"	STALS	The state of the s	THE RESERVE	
17%" 17%"				
17%" 17%"	28"	29"	Cabinet	7601
	28"	29"	2-Drawer 2-Drawer with lock	7602 7602-L
	17%" 28" 29" 17%" 28" 29" 17%" 28" 29"		3-Drawer 3-Drawer with lock	7603 7603-L
				7604 7604-L
17%"	28"	29" 29"	5-Drawer 5-Drawer with lock	7605 7605-L
17%"	28"	29" 29"	6-Drawer 6-Drawer with lock	7606 7606-L
17%"	28"	29" 29"	8-Drawer 8-Drawer with lock	7608 7608-L
END	PANELS			
1%"	28"	29" 29"	with filler without filler	7612-29-F 7612-29-WOF
1%"	28"	31" 31"	with filler without filler	7612-31-F 7612-31-WOF
1%"	28"	33"	with filler without filler	7612-33-F 7612-33-WOF
SUB-	BASES			
1%"	28"	2¼" 4½"		7613-2 7613-4



STORAGE CABINETS

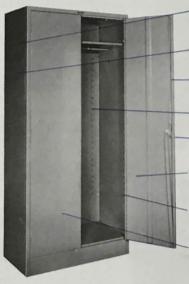


Functional, durable, adaptable. Give maximum protection to tools, dies, delicate instruments, supplies, and personal belongings. Neat and attractive in appearance.









Cabinet is fabricated from cold rolled heavy gauge steel for appearance and durability.

All metal parts are precision engineered. No bolt heads show in front or on side panels.

Positive three-point locking (top, center and bottom) assures even closure all the way around.

 Shelf support strips are integral part of cabinet.

Chrome-plated locking handle has built-in groove cylinder lock.

All-welded door frame assembly, joints are offset to provide for complete flush face. Doors are factory assembled in frame to insure accurate fit.

Shelves easily adjust up or down in 2" increments. Compound channel design for added strength.

Doors swing out quietly a full 180°. Hinges are theft proof for additional security. "HAT" section reinforced.



#### THE BASIC UNIT MODEL 800

Model 800 is the basic unit which can be used for the storage of large items. Converts to a storage cabinet by the addition of Kit "S", to a wardrobe cabinet with Kit "W"; and to a combination cabinet with Kit "Kit "C".

Model	W	D	H
800-3618	36"	18"	78"
800-3624	36"	24"	78"



#### KIT "S" (STORAGE)

Kit S-3618 for 18" deep cabinets. Kit S-3624 for 24" deep cabinets.



#### KIT "W" (WARDROBE)

Kit W-3618 for 18" deep cabinets. Kit W-3624 for 24" deep cabinets.



#### KIT "C" (COMBINATION)

Kit C-3618 for 18" deep cabinets. Kit C-3624 for 24" deep cabinets.



#### STORAGE CABINETS

#### FILM OR TAPE STORAGE.

Any 18" deep Hallowell Cabinet can be converted for efficient film and tape storage by the simple addition of these all-welded steel racks. Adjustable in 2" increments. Order according to table.



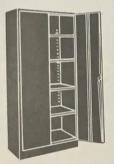
#### 16 MM RACK

No. 8016 26 openings for 400' to 1600' cans

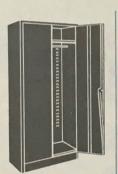


35 MM & COMPUTER TAPE RACK No. 8035 16 openings for 400' to 1600' cans

# Size of Storage Cans Max. No. of Racks per Cabinet 400' or 600' cans 7 800' cans 5 1200' or 1600' cans 4 Computer Tape Cans 4



She



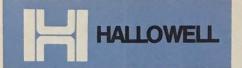




	Double door storage cabinet Wardrobe cabinet. D with four shelves adjustable door—holds 12 to 16			
	MODEL 815	MODEL 835	MODEL 855	MODEL 1486
elf		Wardrobe cabinet. Double door—holds 12 to 16 heavy coats or jackets. Full width hat shelf.	Double door combination cabinet. Stores supplies as well as wardrobe. Four shelves adjustable on 2" centers. Full width hat shelf. Two coat hooks.	Double door cabinet, 42" counter height. Has two adjustable shelves.

	Model Number	Model Number	Model Number	Model Number
18"	815-S-18	815-W-18	855-C-18	1486-18
24"	815-S-24	815-W-24	855-C-24	1486-24

NOTES: Cabinets are 36" wide, 78" high (except model 1486).



# STORAGE WALLS

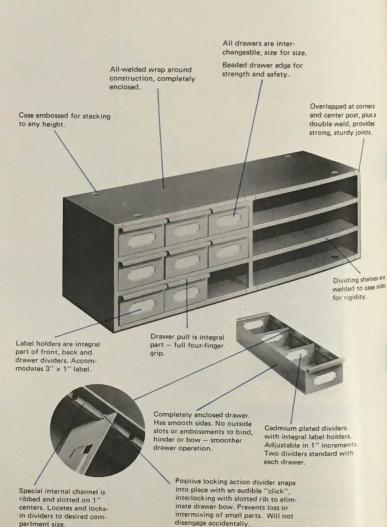


Hallowell Storage Walls turn dead space into working storage space. Each storage wall is a virtual "honeycomb" of individually labeled drawers that are easy to see and reach. Super strong, rigid construction. Ideal for keeping and cataloging large quantities of small parts, whatever the business or industry.











# STORAGE WALLS



12 drawers. Each 2-5/8" high, 8" wide. Divider No. 1183



14 drawers, Each 2-5/8" high, six 5-1/4" wide, eight 8" wide. Divider No. 1183 for 8" drawers Divider No. 1153 for 5-1/4" drawers

		Dimensions				Dimensions	
Model Number	Width	Depth	Height	Model Number	Width	Depth	Height
1111-12 1117-12	33-3/4" 33-3/4"	11-1/4" 17-1/4"	10-1/2" 10-1/2"	1111-14 1117-14	33-3/4" 33-3/4"	11-1/4" 17-1/4"	10-1/2" 10-1/2"



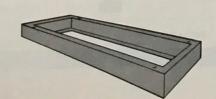
16 drawers. Each 2-5/8" high, four 8" wide, twelve 5-1/4" wide.

Divider No. 1183 for 8" drawers Divider No. 1153 for 5-1/4" drawers



18 drawers. Each 2-5/8" high, 5-1/4" wide. Divider No. 1153

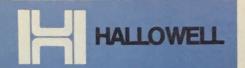
STATE OF THE PARTY		Dimensions				Dimensions	
Model Number	lumber Width	Depth	Height	Model Number	Width	Depth	Height
1111-16 1117-16	33-3/4" 33-3/4"	11-1/4" 17-1/4"	10-1/2" 10-1/2"	1111-18 1117-18	33-3/4" 33-3/4"	11-1/4" 17-1/4"	10-1/2" 10-1/2"



#### BASES

Use when units rest directly on floor.

Day No.	Dimensions				
Part Number	Width	Depth	Height		
1115	33-3/4"	11-1/4"	4"		
1175	33-3/4"	17-1/4"	4"		



# STORAGE WALLS



24 drawers. Each 1-3/4" high, 5-1/4" wide. Divider No. 1152



28 drawers. Each 1-3/4" high, twelve 5-1/4" wide, sixteen 4" wide. Divider No. 1152 for 5-1/4" drawers

Divider No. 1142 for 4" drawers

		Dimensions			Dimensions			
Model Number	Width	Depth	Height	Model Number	Width	Depth	Height	
1111-24	33-1/4"	11-1/4"	10-1/2"	1111-28	33-1/4"	11-1/4"	10-1/2"	
1117-24	33-1/4"	17-1/4"	10-1/2"	1117-28	33-1/4"	17-1/4"	10-1/2"	



32 drawers. Each 1-3/4" high, 4" wide. Divider No. 1142





# MOUNTING KITS

11-A kits for mounting units under steel tops. 11-B kit for all wood tops.

Part Number	Depth
11-A-24	24"
11-A-29	24"
11-A-36	36"
11-B	For all wood tops



#### EXTRA DIVIDERS

Part Number	Width	Height
1142	3-7/8"	1-5/8"
1152	5-3/16"	1-5/8"
1153	5-3/16"	2-1/2"
1183	7-7/8"	2-1/2"

#### **FEATURES**

Strong, sturdy construction. Designed to provide industrial seating in the correct posture for best work performance. Wide range of accessories: round or formed seats, angle or tubular legs, castors for mobility, cushions for extra comfort.



STOOLS AND CHAIRS



MODEL 1232 Knocked Down (KD) Package. Steel or hardboard-covered steel seats. Three basic heights each adjustable in 1" increments to five different heights. Steel glides are standard. Stools are shipped knocked down (KD) in two cartons with seats and legs in separate cartons, Each KD package contains parts for ten adjustable stools. Saves valuable warehouse space.



Model Number	Description	Adj. Seat Height Range
1232-S-1822	KD Package #1822, Ten Adjustable Stools, Steel Seats	18"-22"
1232-M-1822	KD Package #1822, Same as Above with Presdwood Seats	18"-22"
1232-S-2327	KD Package #2327, Ten Adjustable Stools, Steel Seats	23"-27"
1232-M-2327	KD Package #2327, Same as Above with Presdwood Seats	23"-27"
1232-S-2832	KD Package #2832, Ten Adjustable Stools, Steel Seats	28"-32"
1232-M-2832	KD Package #2832, Same as Above with Presdwood Seats	28"-32"









# STOOLS AND CHAIRS

STANDARD POSTURE STOOLS provide economical seating in a variety of models and sizes. Have 14" diameter steel or hardboard-covered steel seat.

Model	Description	Fixed Seat Height	Glide Steel	Leg Cap Rubber	Leg Cap Rubber & Sted
M	Steel Seat	18" 22" 24" 26" 28" 30"	1200-S-18 1200-S-22 1200-S-24 1200-S-26 1200-S-28 1200-S-30	1200-S-18A 1200-S-22A 1200-S-24A 1200-S-26A 1200-S-28A 1200-S-30A	1200-S-188 1200-S-228 1200-S-248 1200-S-268 1200-S-288 1200-S-308
	Hardboard Seat	18" 22" 24" 26" 28" 30"	1200-M-18 1200-M-22 1200-M-24 1200-M-26 1200-M-28 1200-M-30	1200-M-18A 1200-M-22A 1200-M-24A 1200-M-26A 1200-M-28A 1200-M-30A	1200-M-188 1200-M-22B 1200-M-24B 1200-M-26B 1200-M-28B 1200-M-308
	Steel Seat & Clamped Steel Back	18" 22" 24" 26" 28" 30"	1206-S-18 1206-S-22 1206-S-24 1206-S-26 1206-S-28 1206-S-30	1206-S-18A 1206-S-22A 1206-S-24A 1206-S-26A 1206-S-28A 1206-S-30A	1206-S-18B 1206-S-22B 1206-S-24B 1206-S-26B 1206-S-28B 1206-S-30B
	Hardboard Seat & Clamped Wood Back	18" 22" 24" 26" 28" 30"	1206-M-18 1206-M-22 1206-M-24 1206-M-26 1206-M-28 1206-M-30	1206-M-18A 1206-M-22A 1206-M-24A 1206-M-26A 1206-M-28A 1206-M-30A	1206-M-18B 1206-M-22B 1206-M-24B 1206-M-26B 1206-M-28B 1206-M-30B
	Hardboard Seat & Clamped Steel Back	18" 22" 24" 26" 28" 30"	1206-MS-18 1206-MS-22 1206-MS-24 1206-MS-26 1206-MS-28 1206-MS-30	1206-MS-18A 1206-MS-22A 1206-MS-24A 1206-MS-26A 1206-MS-28A 1206-MS-30A	1206-MS-18B 1206-MS-22B 1206-MS-24B 1206-MS-26B 1206-MS-28B 1206-MS-30B
	Steel Seat & Hinged Steel Back	18" 22" 24" 26" 28" 30"	1212-S-18 1212-S-22 1212-S-24 1212-S-26 1212-S-28 1212-S-30	1212-S-18A 1212-S-22A 1212-S-24A 1212-S-26A 1212-S-28A 1212-S-30A	1212-S-188 1212-S-228 1212-S-248 1212-S-268 1212-S-288 1212-S-308
	Hardboard Seat & Hinged Wood Back	18" 22" 24" 26" 28" 30"	1212-M-18 1212-M-22 1212-M-24 1212-M-26 1212-M-28 1212-M-30	1212-M-18A 1212-M-22A 1212-M-24A 1212-M-26A 1212-M-28A 1212-M-30A	1212-M-188 1212-M-22B 1212-M-24B 1212-M-268 1212-M-28B 1212-M-30B
102	Hardboard Seat & Hinged Steel Back	18" 22" 24" 26" 28" 30"	1212-MS-18 1212-MS-22 1212-MS-24 1212-MS-26 1212-MS-28 1212-MS-30	1212-MS-18A 1212-MS-22A 1212-MS-24A 1212-MS-26A 1212-MS-28A 1212-MS-30A	1212-MS-18B 1212-MS-228 1212-MS-24B 1212-MS-26B 1212-MS-28B 1212-MS-30B



# STOOLS AND CHAIRS

Description	Adj. Seat Height Range	Glide Steel	Leg Cap Rubber	Leg Cap Rubber & Steel
		1230-S-18 1230-S-23 1230-S-28	1230-S-18A 1230-S-23A 1230-S-28A	1230-S-18B 1230-S-23B 1230-S-28B
Hardboard Seat	18"-22"	1230-M-18	1230-M-18A	1230-M-18B
	23"-27"	1230-M-23	1230-M-23A	1230-M-23B
	28"-32"	1230-M-28	1230-M-28A	1230-M-28B
Steel Seat	18"-22"	1233-S-18	1233-S-18A	1233-S-18B
& Clamped	23"-27"	1233-S-23	1233-S-23A	1233-S-23B
Steel Back	28"-32"	1233-S-28	1233-S-28A	1233-S-28B
Hardboard Seat	18"-22"	1233-M-18	1233-M-18A	1233-M-18B
& Clamped	23"-27"	1233-M-23	1233-M-23A	1233-M-23B
Wood Back	28"-32"	1233-M-28	1233-M-28A	1233-M-28B
Hardboard Seat	18"-22"	1233-MS-18	1233-MS-18A	1233-MS-18B
& Clamped	23"-27"	1233-MS-23	1233-MS-23A	1233-MS-23B
Steel Back	28"-32"	1233-MS-28	1233-MS-28A	1233-MS-28B
Steel Seat	18"-22"	1236-S-18	1236-S-18A	1236-S-18B
& Hinged	23"-27"	1236-S-23	1236-S-23A	1236-S-23B
Steel Back	28"-32"	1236-S-28	1236-S-28A	1236-S-28B
Hardboard Seat	18"-22"	1236-M-18	1236-M-18A	1236-M-18B
& Hinged	23"-27"	1236-M-23	1236-M-23A	1236-M-23B
Wood Back	28"-32"	1236-M-28	1236-M-28A	1236-M-28B
Hardboard Seat	18"-22"	1236-MS-18	1236-MS-18A	1236-MS-18B
& Hinged	23"-27"	1236-MS-23	1236-MS-23A	1236-MS-23B
Steel Back	28"-32"	1236-MS-28	1236-MS-28A	1236-MS-28B
	Steel Seat  Hardboard Seat  Steel Seat & Clamped Steel Back  Hardboard Seat & Clamped Wood Back  Hardboard Seat & Clamped Steel Back  Steel Seat & Hinged Steel Back  Hardboard Seat & Hinged Wood Back  Hardboard Seat & Hinged Wood Back  Hardboard Seat	Steel Seat	Steel Seat   18"-22"   1230-S-18   1230-S-23   1230-S-28   1230-	Seat Height Height Range

TUBULAR STOOLS AND CHAIRS • Id	eal for lab, classroom, shop.			
Model		Adj, Seat Height Range	Glide Steel	Casters Rubber
7	Round Seat No Footrest With Footrest With Footrest	17"-21" 22"-26" 27"-31"	1241-R-17 1241-R-22 1241-R-27	1241-R-17C 1241-R-22C 1241-R-27C
	Round Seat Wood hinged back No Footrest With Footrest With Footrest	17"-21" 22"-26" 27"-31"	1245-R-17 1245-R-22 1245-R-27	1245-R-17C 1245-R-22C 1245-R-27C
中国	Shaped Seat Wood hinged back No Footrest With Footrest	17"-21" 22"-26" 27"-31"	1276-C-17 1276-C-22 1276-C-27	1276-C-17C 1276-C-22C 1276-C-27C
	With Footrest		Adj.	Glide Steel

	Description	Casters Rubber	Model	Description	Seat Height	Glide Steel
Model	Filing Stool			Shaped Seat Hinged-type	18"-22"	1255-W-18
厢	14" high Hardboard Seat 2" Rubber Casters	1220-M	国	Wood Back	22"-26"	1255-W-22



# STOOLS AND CHAIRS PARTS AND ACCESSORIES

Backs Include Spring Steel rod and hardware

Cushions

**Backrest Cushion** 

Fits all backs, 1" foam

pad. Snaps on easily

Other Accessories

Hardboard Seat

12-3/4" diameter, 1/8" thick.

For models 1200 thru 1236

Clamp-Type Back Adjustable for height only

For Models 1200, 1230 and 1232.



Steel Back 12000-S



Gray Vinyl Cover 12030 Gray Fiber Weave Cover 12030-F

Natural Finish 12040-M

Wood Back 12000-W

Round Seat Cushion Fits all round seats. 1" foam cushion.



Gray Vinyl Cover 12032 Gray Fiber Seave Cover 12032-F

Rubber Leg Caps Fits all stools and chairs Except 1241, 1245 and 1276. Set of four



12060 12060-S

All Moulded Rubber Rubber with Steel Glide Insert

Hinged-Type Back Adjustable for height and angle For Models 1200, 1230 and 1232



Steel Back 12020-S Wood Back 12020-W



For Model 1241 Wood Back 12022-W

**Shaped Seat Cushion** 1" foam cushion, Easy Snap-on installation.



Gray Vinyl Cover 12034 Gray Fiber Weave Cover 12034-F

Swivel Casters For models 1241, 1245 and 1276 only, 1-5/8" diameter. Set of four

Rubber 12065

# **FEATURES**

Trim, attractive, sturdy. Combines a large, smooth writing surface with convenient storage in pigeonhole top units, drawers, or cabinet bases. Basic desk unit can be wall mounted.



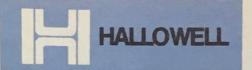
# **FOREMEN'S DESKS**

Basic desk unit is 37-3/4" wide, 25" deep, 7-1/4" high in front and 16" high in back. Includes pigeon hole unit and drawer. Overall height with legs is 43-1/4" in front and 52-1/2" in back.









FOREMEN'S DESKS







specify 14016-C



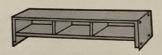
With casters, specify 14017-C

MODEL		MODEL 14013		MODEL 14014 MODEL 14016 MODEL		MODEL 14014		MODEL 14016			
C	onsists of:		Co	Consists of Model 14013, plus: Consists of Model 14014,		model ito					
Qty.	Part No.	Description	Qty.	Part No.	Description	Qty.	Part No.	Description	Qty.	Part No.	Description
1 set	14010	Basic Desk Unit with pigeonhole top and drawer Lower shelf, pair of shelf supports, and 4 legs.	1	14003	Extra Drawer	2	14003	Extra Drawers	1	14010	Basic Desk Unit with pigeonhole top and drawer Cabinet base
	With casts specify 14			With cast			With casts			With cast	



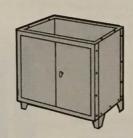
#### FOREMEN'S DESKS

#### PARTS AND ACCESSORIES



#### Extra Pigeonhole Unit

Mounts above regular pigeonhole top unit. 37-3/4" wide, 8-3/4" deep, 7" high. Hardware included. Part No. 14001



#### Cabinet Base

Door clearance is 33-1/4" wide x 27-1/2" high. Cabinet 23-1/4" deep has shelf 35-3/4" wide x 22-1/8" deep adjustable on 2" centers. Chrome locking T handle.
Part No. 14008



#### Extra Drawer Unit

23-7/8" wide, 3" high 23" deep, inside. Chrome cylinder lock. Part No. 14003



# Desk Body Unit

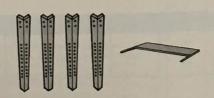
Desk Body Officers, 25" deep, 7-1/4" high at front, 16" high at back. Drawer is 23-7/8" wide, 23" deep and 3" high. Includes pigeonhole unit with end opening. 12-1/8" wide center 12". All 3" high, 8-3/4" deep.
Part No. 14010



#### **MODEL 14018**

Consists of:

Qty.	Part No.	Description
1	14010	Basic Desk Unit with pigeonhole top and drawer
1 set	14012	Wall brackets.



# Desk Legs and Lower Shelf

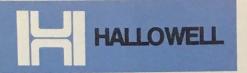
Set of four legs, 42-1/2" high. One shelf, 12" deep and one pair shelf support angles. Part No. 14004



3" Dia. Casters — Set of 4 (Use with No. 14008 Cabinet) 14850R Rubber 14850S Steel

2" Dia. Casters — Set of 4 Stem type, rubber

2 w/wheel locks Use on 14004 legs 14019 Rubber



# INDUSTRIAL CABINETS

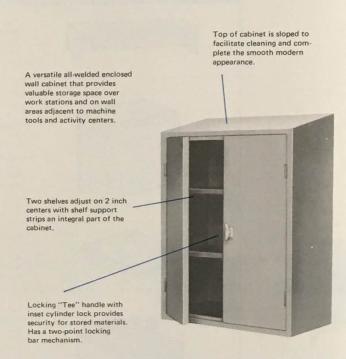


Wide selection including wall and floor models. Fine for safe, nearby storage of valuable tools, parts, supplies. Sturdy heavy gage steel construction. Doors have chrome locking handles. Portable models available. Can be used to mount vise, grinder, or office machine.









Width	Depth	Height	Model
24"	12"	Front 30" Back 33"	1469-1224



# INDUSTRIAL CABINETS

Model and Description	Width	Depth	Height	Model Number
SHELVES adjust on 2" centers without the use of tools. Two full width shelves give you complete flexibility in your storage requirements.  HEAVY DUTY TOP has a 1" flange extended above the working surface on the sides and back to prevent tools and parts from rolling off. Height of cabinet (excluding the 1" flange) measures 35" including 4" legs.  REINFORCED DOOR has chrome finish "tee" locking handle to secure the door at top and bottom. Two keys are provided.  DETACHABLE 4" FEET or 3" swivel type rubber casters are available with this unit.	19-3/8" 19-3/8" 19-3/8"	18"	36" with 4" feet 35-3/4" with 3" casters extra shelf	1470-1820 1472-1820R 14700
REINFORCED SHELVES in two sizes, provides the needed storage area. One shelf adjusts on 2" increments. Shelf supports are a part of the cabinet - no tools necessary when adjusting shelf.  STEEL TOP made of heavy 14 gauge steel has 1" flange extended above work surface on sides and back to prevent tools and parts from rolling off. The work surface (excluding the 1" flange) measures 35" in height including 4" legs.  DOUBLE DOORS are pan reinforced. Right hand door has chrome finish locking "tee" handle to secure the door at the top and bottom. Two keys are provided.  DETACHABLE 4" FEET or 3" swivel type rubber casters are available with this unit.	36" 36" 36" 36" 36"	18" 24" 18" 24" 24"	36" with 4" feet 36" with 4" feet 35-3/4" with 3" casters 35-3/4" with 3" casters extra shelf extra shelf	1480-1836 1480-2436 1482-1836 1482-2436 14800 14820
HALLOWELL COUNTER HIGH STORAGE CABINETS offer the same quality construction features as the full size models shown on the previous page. The 42 inch height provides a smooth surface top for a variety of uses.  FULL-WELDED CONSTRUCTION of frame gives strength and good appearance to the cabinet. Right hand door has chrome-plated cylinder locking handle. Three-point locking (top, center, and bottom) will keep all materials secure.  TWO ADJUSTABLE SHELVES on 2-inch center allows flexible storage of large and small items.	36" 36"	18" 24"	42" 42"	1486-3618 1486-3624



STEEL CARTS

FEATURES Sturdy free-rolling carts carry loads up to 500 lbs. Detachable handle can be used at either end. 3" deep beaded edge trays accommodate large loads safely. Has 5" rubber casters, two swivel and two rigid. Compact design allows use in narrow aisles. Trays can be inverted for flat work surface.





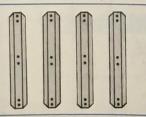




Dimensions				
Width	Depth	Height	MODEL	
			Two Trays	
16" 24"	30" 36"	32-1/4" 32-1/4"	1474-1630 1474-2436	
			Three Trays	
16" 24"	36"	32-1/4" 32-1/4"	1475-1630 1475-2436	
			Five Trays	
16" 24"	30" 36"	58-1/2" 58-1/2"	1476-1630 1476-2436	

#### COMPONENTS

SET OF 4 LEGS





14650 (pr.) Two trays Width 30", Depth 16", Height 3"

14651 (pr.) Two trays Width 36", Depth 24", Height 3"



REPLACEMENT CASTERS

14652 Two swivel casters 5" dia, rubber tread.



14653 Two rigid casters 5" dia. rubber tread.



FEATURES Rugged, durable, mobile. Moves tools and parts directly to job site for increased productivity, then serves as a work station.

# **TOOL STANDS**



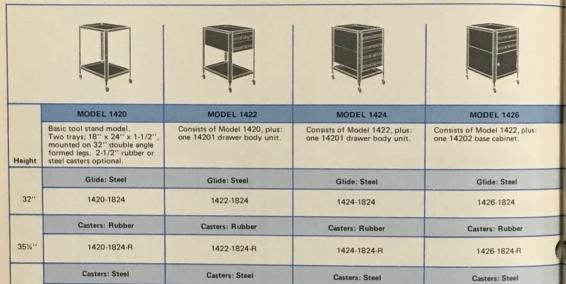








#### **TOOL STANDS**





1422-1824-S

1420-1824-S

35%"



1426-1824-S

1424-1824-S

MODEL		L 1430	MODEL 1432		
Height	Three trays, 18" x 24" x 1-1/2" mounted on 32" double angle formed legs, 2-1/2" rubber or steel casters optional.	Three trays, 20" x 28" x 1.1/2" mounted on 32" double angle formed legs. 2-1/2" rubber or steel casters optional.	Consists of Model 1430-1824, plus: one 6320-1420 drawer.	Consists of Model 1430-2028, plus plus: one 6320-1420 drawer.	
	Glide: Steel	Glide: Steel	Glide: Steel	Glide: Steel	
32"	1430-1824	1430-2028	1432-1824	1432-2028	
	Casters: Rubber	Casters: Rubber	Casters: Rubber	Casters: Rubber	
35%"	1430-1824-R	1430-2028-R	1432-1824-R	1432-2028-R	
	Casters: Steel	Casters: Steel	Casters: Steel	Casters: Steel	
35¼"	1430-1824-S	1430-2028-S	1432-1824-S	1432-2028-8	



# TOOL STANDS







	MODEL	. 1434	MODEL 1450	MODEL 1451
Height	Consists of Model 1432-1824, plus: one 6320-1420 drawer.	Consists of Model 1432-2028, plus: one 6320-1420 drawer.	Three trays, 24" x 36" x 1-1/2", mounted on 32" double angle formed legs. 2-1/2" rubber or steel casters optional.	Consists of Model 1450, plus: one 6320-1420 drawer.
	Glide: Steel	Glide: Steel	Glide: Steel	Glide: Steel
32"	1434-1824	1434-2028	1450-2436	1451-2436
	Casters: Rubber	Casters: Rubber	Casters: Rubber	Casters: Rubber
35¼''	1434-1824-R	1434-2028-R	1450-2436-R	1451-2436-R
	Casters: Steel	Casters: Steel	Casters: Steel	Casters: Steel
35¼"	1434-1824-S	1434-2028-S	-	-









				CONTRACTOR OF THE PARTY OF THE
		MODEL 1453	MODEL 1454	MODEL 1455
	MODEL 1452			124 114 4FO - 145
	Consists of Model 1451 plus: one 6320-1420 drawer.	Consists of Model 1452 with drawers arranged vertically.	Consists of Model 1452, plus: two 6320-1420 drawers.	Consists of Model 1450, plus: one 1117-12 storage wall.
Height			Glide: Steel	Glide: Steel
	Glide: Steel	Glide: Steel	Glide: Steel	
32"	1452-2436	1453-2436	1454-2436	1455-2436
32				Casters: Rubber
	Casters: Rubber	Casters: Rubber	Casters: Rubber	Casters: Nubber
	Control		1454-2436-R	1455-2436-R
35%"	1452-2436-R	1453-2436-R	1454-2430-N	1400 2400 11



#### TOOL STANDS







	MODEL 1456	MODEL 1457	MODEL 1458
leight	Consists of Model 1450, plus: one 1117-18 storage wall.	Consists of Model 1450, plus: one 1117-24 storage wall.	Consists of Model 1450, plus: one 1117-32 storage wall.
	Glide: Steel	Glide: Steel	Glide: Steel
32"	1456-2436	1457-2436	1458-2436
	Casters: Rubber	Casters: Rubber	Casters: Rubber
5%"	1456-2436-R	1457-2436-R	1458-2436-R

#### TOOL STAND ACCESSORIES



Drawer Unit Part No. 14201 Two drawers, 14" W x 20" D x 5" H. Cylinder Locks available.



Cabinet Unit
Part No. 14202
Enclosed cabinet 14" W x 24" D x 14" H.
Door has chrome lock handle.
(Use on 18" x 24" stand)



Swivel Casters (Set of 4)
Ball bearing type.
2-1/2" dia, for 18" x 24" and 20" x 28" tool stands.
Part No. 03508A (Rubber)

Part No. 03509A (Steel)
3" dia. for 24" x 36" tool stands
Part No. 03570A (Rubber only)

FEATURES 14" and 20" wide drawers, all-welded construction, fully enclosed. Have knock-outs for cylinder locks, recessed pulls, attractive ribbed flush fronts. Drawer cases bolt together and to bottom frame and top tray. 5" rubber, swivel-type casters provide mobility. Drawers glide on nylon rollers, have built-in stops, and are easily removed without tools. These drawer stands provide storage and easy mobility.



MOBILE DRAWER STANDS





	MODEL 1460		MODEL 1462		
	Consists of four drawers, 14" x 20" x 5" and 5" rubber casters.	Consists of three drawers, 14" x 20" x 5" and 5" rubber casters.	Consists of four drawers, 20" x 20" x 6" and 5" rubber casters.	Consists of three drawers, 20:" x 20" x 6" and 5" rubber casters.	
Height				_	
311/2"	1460-4A	_			
25"		1460-3A	1462-4B	- N	
35½"	_		1462-46	1462-3B	
31"	_				

Kits for Mobile Drawer Stands
Consist of 1 top tray, 1 platform and four
5" rubber, swivel casters plus hardware.
Add any number of drawers.

Part No. 1460 A for 14" x 20" drawers Part No. 1462 B for 20" x 20" drawers



LOCKERS

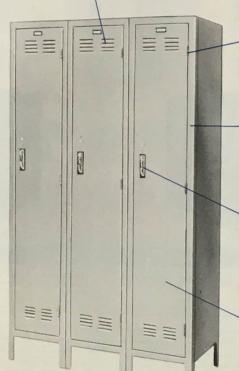
FEATURES Spacious and attractive; efficient and roomy; strong, secure, and durable. Basic construction features are shown below. As standard equipment, Hallowell lockers are provided with flat tops, 6" legs, and standard louvers. Optional accessories — locks, sloping tops, closed bases, and other components — can also be provided to meet installation requirements. Lockers are shipped knocked down with complete, easy to follow assembly and installation instructions.







INVERTED LOUVERS Hallowell lockers have unique modular banks of inverted louvers. There are no protruding edges to be damaged, no exposed surfaces to gather dust and moisture. This is truly functional louver design that provides ample interior ventilation, adds rigidity to the doors, and reduces locker maintenance and upkeep problems.



STREAMLINED HINGE The new Hallowell locker utilizes smooth, unobtrusive hinges and fastenings. This double leafed hinge has a 2" tight pin and is a five knuckle, butt type made of heavy gauge cold-rolled steel.

DOOR FRAME MEMBERS of the Hallowell locker are smooth, heavy gauge cold-rolled steel. The whole Hallowell locker is built to take rough treatment — the welded construction makes loosening and rattling impossible.

VANDAL PROOF HANDLE Patent No. 3,074,750 — Using a zinc alloy with superior qualities, die-cast under rigid quality control, Hallowell has achieved the ultimate in locker handle design. The case shields the handle slide from abuses such as kicking or pounding, and the entire handle unit is secured to the locker at 6 individual points. The handle case prevents the padlock from marring the locker door.

BAKED ON ENAMEL FINISH All steel surfaces are iron phosphate coated to inhibit rust and etch the surface for maximum paint adhesion. A top quality enamel is uniformly applied and baked on. This creates a long lasting finish easy to clean and resistant to chipping and sunlight.



SINGLE TIER Most popular of all lockers — provides storage for full length garments.



SHELF 9" from the top for small items.

HOOKS 12" wide lockers have one double prong ceiling hook and two single prong side hooks. 15" and 18" wide lockers have one double prong ceiling hook and four single prong side hooks.

COAT RODS 18" and 21" deep lockers have a coat rod instead of ceiling hooks.

DOOR The Hallowell exclusive automatic prelocking device is standard on this model. The unit may be equipped with a padlock, built-in combination lock or a flat key lock. (See Accessories, page 122.)

NUMBER PLATES Included for each door — specify numbering sequence with your order.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

SHIPPED - KD with doors assembled to frame.

DOUBLE TIER Ideal storage for areas where full length coats are not worn.



HOOKS 12" wide lockers have one double prong ceiling hook and two single prong side hooks. 15" wide lockers have one double prong ceiling hook and four single prong side hooks.

DOOR Equipped with the Hallowell exclusive prelocking device for maximum protection. A padlock, built-in combination or flat key lock will work on this unit. (See Accessories, page 122.)

NUMBER PLATES Included for each door — specify numbering sequence with your order.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

SHIPPED - KD with doors assembled to frame.



#### SINGLE TIER - ONE WIDE SECTION

1	Dimensio	ns		
Width	Depth	Height	Model	
12	12	72	660032	
12	18	72	660040	
15	18	72	660048	



#### DOUBLE TIER - ONE WIDE SECTION

1	Dimensio	ons	
Width	Depth	Height	Model
12	12	36	660096
15	18	36	660112



#### SINGLE TIER - THREE WIDE SECTION

	Dimensio	ns	
Width	Depth	Height	Model
12	12	72	660033
12	18	72	660041
15	18	72	660049

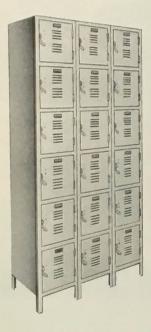


#### DOUBLE TIER - THREE WIDE SECTION

				_
	Dimensio	ens		
Width	Depth	Height	Model	
12	12	36	660097	
15	18	36	660113	
	Width 12	Width Depth	12 12 36	Width         Depth         Height         Model           12         12         36         660097



MULTIPLE TIER-5 HIGH AND 6 HIGH Ideal for limited storage in bowling alleys, gymnasiums and many industrial applications. Perfectly suited to areas where storage of bulky apparel is not involved. The unit is available in five or six high sections.



DOOR Equipped with a gravity type latch that keeps door securely closed when not locked. The simplicity of this latch (no springs or parts to bend) assures dependable operation and maximum security. Padlocks or flat key locks may be used for secure storage. (See Accessories, page 122.)

NUMBER PLATES Included for each door - specify numbering sequence with your order.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

SHIPPED - KD with doors assembled to frame.

#### MULTIPLE TIER-5 HIGH - ONE WIDE SECTION

	DESCRIPTION OF PERSON IN	11 4	4 11 21
--	--------------------------	------	---------

0	pening S	ize	
Width	Depth	Height	Model
12	12	12	660172
12	15	12	660180

#### MULTIPLE TIER-5 HIGH - THREE WIDE SECTION

DE	T	E
H R.		1
100	1	E
N IN	1	Ŀ
No. of Street, or other Persons	E	L

	ize	pening S	0
Model	Height	Depth	Width
660173	12	12	12
660181	12	15	12

#### MULTIPLE TIER-6 HIGH - ONE WIDE SECTION

	100
1	No.
1	南

Model	ize	pening Size		
Model	Height	Depth	Width	
660176	12	12	12	
660184	12	15	12	

#### MULTIPLE TIER-6 HIGH - THREE WIDE SECTION

and and had had an	diam'r.	BR	In No.	NEG	Die Real	R
	THE REAL PROPERTY.	n n	No. of	1	000	10 元

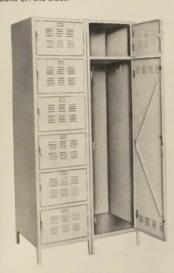
	Ze	pening S	0
Model	Height	Depth	Width
660177	12	12	12
660185	12	15	12

NOTE: Overall height for 5 tier with 6" legs - 66" Overall height for 6 tier with 6" legs - 78"

F.O.B. Santa Ana, Calif.



SEVEN PERSON LOCKER Model consists of seven small compartments for secure storage of personal belongings and supplies with one large compartment for all users to hang their full length garments. Large compartment has coat rod with coat hooks on the sides.

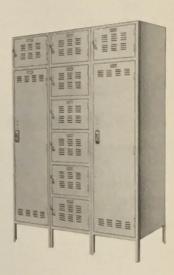


DOOR Gravity type latch on small compartments with automatic prelocking device on large door. May be equipped with padlocks, or when equipped with flat key locks the seven individual compartments are keyed differently, but each key will open the garment compartment door. (Specify seven to pass the eighth when ordering locks.)

NUMBER PLATES Included for each door — specify numbering sequence with your order.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

EIGHT PERSON LOCKER Accommodates eight persons with individual storage compartments while sharing two full length coat compartments. Large compartments have coat rods with coat hooks on the sides.



DOOR Large door has automatic prelocking device with a gravity latch on the small compartments. May be equipped with padlocks or when equipped with flat key locks, the eight individual compartments are keyed different, but each key will fit the companion garment compartment door. (Specify four to pass the fifth when ordering locks.)

NUMBER PLATES Included for each door — specify numbering sequence with your order.

STOCKED COLOR Sandpiper Tan. Other decorator colors available.

Ask your local representative.

	SEVEN PERSON LOCKER				EIGHT PERSON LOCKEN					
					Opening Size			MODEL 660306		
_		Opening Size	MODEL 660301	Width	Depth	Height				
Same la	Width	Depth	Height	Market San						
0	18" 18" 36"	21" 21" 21"	12" 60" 78"	Seven small compartments One large compartment Overall dimensions with 6" legs	18" 18" 54"	21" 21" 21"	12" 60" 78"	Eight small compartments Two large compartments Overall dimensions with 6" legs		



TWO PERSON LOCKER The ideal locker when a change of clothes is involved and when hats, purses and other personal items are to be stored. Each separate small compartment door can be opened only when companion full length locker is open. Each small compartment is 9" high with the coat compartment 7-1/2"W. x 54"H. (overall height is 78" with 6" legs). A coat rod and side hooks are standard equipment with each locker.

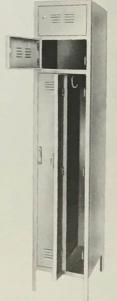
SIXTEEN PERSON LOCKER An economical unit of sixteen private compartments with a coat rod in the center. Each unit is 72" wide x 18" deep x 78" high.

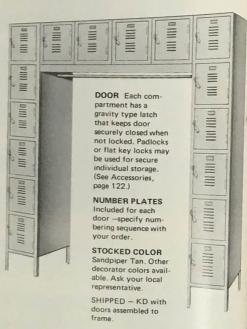
DOOR Unit has an automatic prelocking device designed for use with padlock, built-in combination lock, or a flat key lock. (See Accessories, page 122.)

NUMBER PLATES Two pair included with each two person lockers — specify numbering sequence with your order.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

SHIPPED - KD with doors assembled to frame.





#### TWO PERSON LOCKER SIXTEEN PERSON LOCKER **Opening Size Opening Size** Width Depth Height Model Width Depth Height Model 15" 18" 72" 660247 21" 15" 72" 12" 660253\* 18" 12" 660312\*

\*F.O.B. Santa Ana, Calif.



PACKING HOUSE LOCKER Hallowell's single tier locker with 6" sloping top is specially designed to comply with the Bureau of Animal Industries requirements. Each locker is 15" wide, 18" deep, and 60" high (66" at rear).

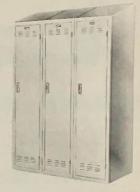
#### PACKING HOUSE LOCKER - ONE WIDE SECTION\*

	Opening Size			
Till I	Width	Depth	Height	Model
	15"	18''	60"	660327 Locker Only
PA	15"	32"	16"	781005 Base Only

#### PACKING HOUSE LOCKER - THREE WIDE SECTION \*\*

	0	pening S		
121 22-12	Width	Depth	Height	Model
3 3 1	15"	18"	60''	660328 Locker Only
1	45"	32"	16"	781006 Base Only

 Order both locker and base for complete unit — overall size 15" wide x 32" deep x 82" high including sloping top.  Order both locker and base for a complete unit — overall size 45" wide x 32" deep x 82" high including sloping top.





BASE Elevates the lockers 16" off the floor per B.A.I. inspection requirements. The base extends in front with an 11" wide wooden seat. Base is available in one or three wide widths.

SHELF 9" from the top for storing small items.

HOOKS Each locker has a coat rod with coat hooks at the sides.

DOOR The Hallowell automatic prelocking device is standard with this model. The unit may be equipped with padlock, built-in combination or a flat key lock. (See Accessories, page 122.)

NUMBER PLATES Included for each door — specify numbering sequence when ordering.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

SHIPPED - KD with doors assembled to

Minimum quantity per order 50 openings.



LOCKER ACCESSORIES



#### **EXTRA NUMBER PLATES**

Polished aluminum number plates with numerals etched, then filled with black enamel. Fastened to doors with nuts and bolts. Please specify numbering sequence with your order.

Number plates are furnished with all Hallowell lockers. NOTE: Please specify numbering sequence with your order.

Part Number 429876





#### LOCKS

Locker locks must be ordered separately. Popular and economical flat key lock, (illustrated) is furnished with two keys and master keyed where required. Builtin combination locks and padlocks are also available. Ask your local representative.

> Part Number 661106 661107 661108 661113 .....

> > 661137

661138

661143

661144

618043

618053

618063

Part Number

Flat Key Lock

291325



#### SLOPING EXTENSION TOPS

Promotes better housekeeping, prevents accumulation of dust, personal effects, and debris on locker tops. Available in one wide or three wide units that bolt to the flat top lockers.

STOCKED COLOR Sandpiper Tan. Other decorator colors available. Ask your local representative.

SHIPPED - KD to save freight.



	ONE	
00000		
wi	DE SECTION	

	1	TI	н	R	E	E		
WI	D	E	S	E	C	Т	10	N

	Managed School	
12"	12"	
12"	15"	
12"	18"	
15"	15"	
11.00	15	
15"	18"	

15"

18"

15"

18"

Width

L	,,,	10	001114
ı	18"	18"	661120
	18"	21"	661121
T	12"	12"	661136



EE		
CT	ION	

	1.4
-	12"
17	12"
	15"
	15"

18"	18"	66115
18"	21"	
10	41	66115



#### **CLOSED BASES**

Front and end closed bases provide a smart flush front appearance - prevent accumulation of dust and debris in inaccessible areas beneath lockers making locker rooms easier to clean. Bases are bolted between 6" high legs.



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ı	12"	ı
1		١
1	15"	١
1	18"	ı
1		ı





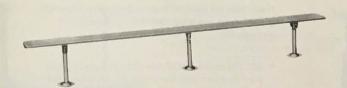
12"	
15"	
18"	

618203
618213
618223

21" 618233



#### LOCKER ACCESSORIES





#### LOCKER ROOM BENCHES

Select straight grained wood with clear varnish finish -1.3/8" thick  $\times 9.1/2$ " wide. Pedestals support bench top approximately 17" above floor levels. Adjustable clamps adapt to variations in floor levels.

STOCKED PEDESTAL COLOR 49 Gray — Pedestal available separately if desired.

Length	Part Number	
5'10"	660354	
7'10"	660357	
8'10"	660360	
9'10"	660363	
Pedestal Only Height – 16"	780524	
F.O.B. Santa Ana	, Calif.	

#### LOCKER SPECIFICATIONS

FRAME To be constructed of heavy gauge steel uprights and heavy gauge steel cross members, with four projection welds at each of the four corners. Upright members to extend to the floor, forming legs if specified. Tops, bottoms, and interbottoms of lockers to be bolted to these cross members, as well as to the body of locker. The frame is to have a flush exterior and smooth finish.

DOOR Semi-flexible type, 16 gauge steel. Doors are ventilated with banks of inverted louvers, providing flush exterior door surface.

LATCHING DEVICE Box locker doors to be used with a padlock, dead-bolt lock or without locks, must have a positive type latch, which will keep door securely closed when not locked. Box locker doors to be used with a lock having a beveled spring bolt must have a lip lip extending over frame to protect bolt. Unless specified otherwise, all lockers 18" high and over to have automatic spring bolt action latching device, permitting the door to be pre-locked; that is locked before the door is closed and to automatically latch in locked position when the door is pushed shut. Latch bar to completely enclosed latching fingers, thereby making device non-pickable.

#### SILENCING DEVICE Live rubber.

HANDLE Stationary handle case to be secured to door at six points; the handle slide must be fully protected at top and bottom by stationary case to minimize abuse. Any blow directed to hits handle will be absorbed by the stationary case and cannot be transmitted to the handle slide, the latching mechanism, or the lock bolt. The handle must not provide openings or surfaces where leverage may be applied to force handle upward when in a locked position. All parts of handle to be cast zinc alloy, with a bright chrome finish. Handle must provide a padlock eye for 3/8" shackle padlock, and provide a padlock strike to protect finish of door.

HINGES Heavy duty 2" tight pin, full loop, five knuckle, butt-type hinges. Hinges to be securely attached to frame and bolted to door with two 3/16" x 7/16" slotless bolt and shake-proof locking Kep nuts. Hinge pin must not be embossed in door where it can be easily disengaged by removing hinge clip. Hinge pin must be so constructed that it cannot be removed. Doors over 48" high to have three hinges.

BACKS AND SIDES To be 24 gauge, unless specified otherwise. All backs have 3/4" flanges. All exposed sides to have flanges where they intermember with backs, making double flanges at all exposed rear corners. All exposed ends to have 16 gauge panel ends over standard locker ends when specified.

TOPS Flat or sloping -24 gauge steel, unless specified otherwise. Bolted to frame, as well as to body of locker. Rise on sloping tops to be 1/3 the depth of the locker.

SHELVES Single tier lockers 54" high and over to have one shelf as standard. Shelves to be 24 gauge, with formed front -9" from top of locker.

COAT RODS To be furnished in single tier lockers 54" high and over which are 18" or more in depth.

HOOKS Rust proofed. Lockers 30" or over in height, unless specified otherwise, to have one double-prong ceiling hook. Lockers 18" and over to have 2 side hooks. All hooks must be attached with a minimum of two bolts.

FINISH All steel surfaces are thoroughly cleaned and processed through a 5-stage bonding and rust inhibitive phosphate treatment to provide a chemically clean corrosion inhibiting surface. The finish coat shall be a high quality enamel that is electrostatically applied and baked on. The film thickness of paint on all exposed locker doors, frames, filler panels, baskets and racks shall average 1.5 mils. The film thickness of paint on all other parts shall average 1 mil.

**NUMBER PLATES** To be non-corrosive, with 3/8" black figures — numbering as required.

VENTILATION Doors are ventilated as standard with modular banks of inverted louvers, which provide flush exterior door surface.



**CUSTOM SHEET METAL FABRICATION** 

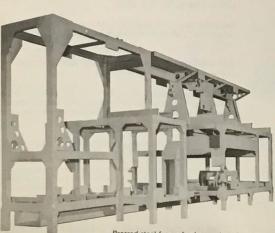
A SPECIAL CAPABILITY A glance through the pages of this catalog will point out the wide variety of sheet metal fabricated products and components that have been manufactured and sold by Hallowell. In addition, Hallowell will contract to manufacture custom products, Examples of these contract items are shown here to illustrate the wide range of our capabilities.



If you have the need for custom sheet metal fabrication in production quantities, consider our capacity for performance;

- 400,000 square feet of manufacturing space in two plant locations with manpower and equipment geared for production.
- Coil steel slit, sheared, and edged on modern equipment. Over 75 power presses and brakes with capacities to 1,000 tons. Spot, arc, and specialty welding equipment.
- Tool rooms equipped for production and maintenance of tools, dies, jigs, and fixtures.
- Finishing to exacting specifications by Electro-Deposition and Electro-Static paint systems.

Inquiries are invited for additional information, engineering consultation or price quotations. Please call our Contract Sales Dept., or write Hallowell Division, Standard Pressed Steel Co., Hatfield, Pa. 19440 or Santa Ana, California, 92702.



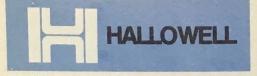


Pressed steel frame for heavy duty instrumentation



CUSTOM SHEET METAL FABRICATION





**CUSTOM SHEET METAL FABRICATION** 





#### STORAGE SYSTEMS



#### HALLOWELL "The Storage Systems People"

The primary function of warehouse storage operation is the accumulation and segration of stock for future order filling or use in production. An efficient system must provide for:

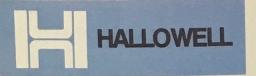
- 1. Easy access
- 2. Quick storing and picking
- 3. Optimum space utilization
- 4. Minimum personnel requirements

A storage system requires extensive capabilities in design, engineering, manufacturing and installation. You get all this from one source — Hallowell. Hallowell tailors storage systems to fit your needs. Standardization is the key — a new dimension for storage solutions.

It all started with ERECTOMATIC standard flush upright posts with one-piece clips. Then multi-level storage — double deck and triple deck — utilizing standard cataloged components. The evolution through widespan shelves and ultimately to High Density storage by use of H-Posts parts — high strength tubular posts and beams compatible with all other components — led to the introduction of the Hallowell Hustler. This travelling order picker now permits designs of High Rise storage and retrieval systems,







#### STORAGE SYSTEMS

Whatever your requirements may be:

Single level storage with special equipment

Multi-level storage - double or triple deck

High rise storage and retrieval with order picker

Or a combination of these

Hallowell offers total systems and turn-key responsibility... with complete in-house technology and engineering design. A Hallowell team of specialists will integrate shelving, decking, and storage machines with conveyors, controls, storage rack, infeed and discharge equipment, computers and special equipment to provide the most efficient and economical answer to your storage needs.

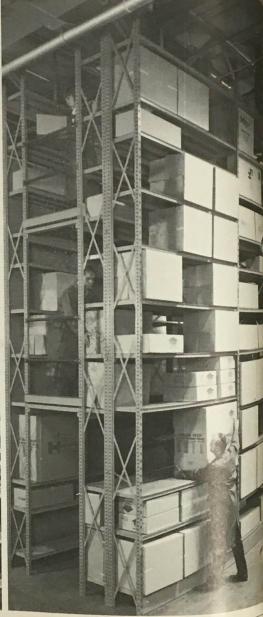
Call or write your nearest distributor or our Storage Systems Sales Department, Hallowell Division, Standard Pressed Steel, Hatfield, Pa. 19440, Telephone 215-723-6011.

Storage Systems Sales Department Hallowell Division Standard Pressed Steel

Hatfield, Pa. 19440 Phone: 215-723-6011

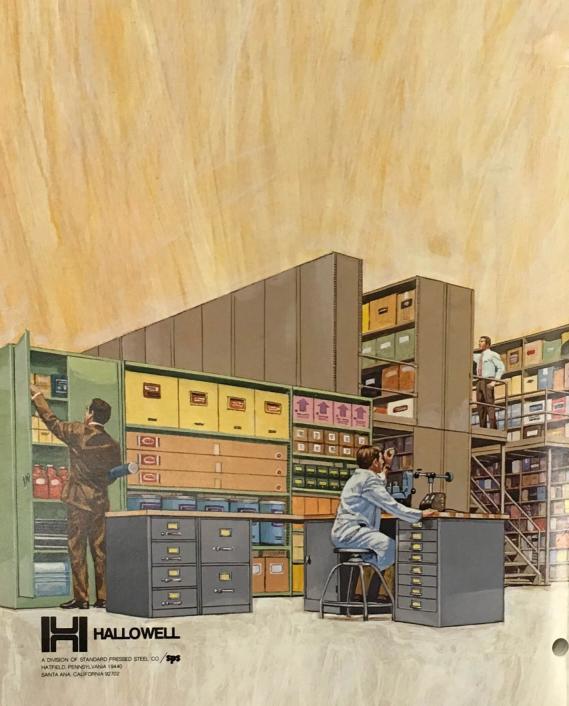
2701 South Harbor Boulevard Santa Ana, California 92702 Phone: 714-545-9311





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FORM 3640 75M-274-SPS

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October 22, 1974

Frank W. Rhea, New Mint Project Manager U.S. Department of the Treasury Denver Mint 320 W. Colfax Av. Denver, Colorado 80204

Dear Mr. Rhea:

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Thank you for your consideration and I look forward to sending you your Selection Guide in the near future.

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D. R. Cameron

Industrial Sales Manager Quick Coupling Division

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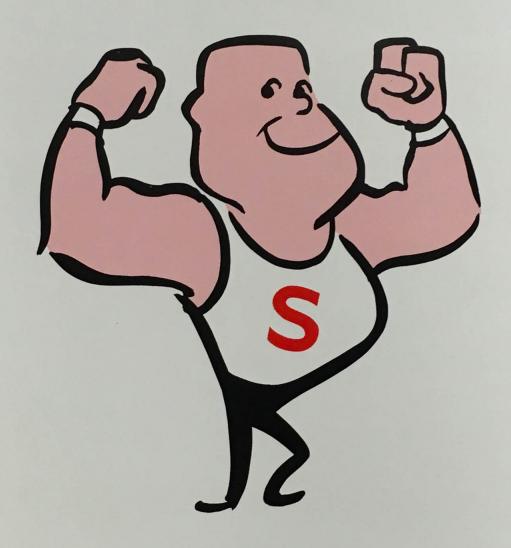
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**CINCINNATI, OHIO 45242** 

# SHEFFER® CYLINDERS THE MUSCLES OF AUTOMATION



- The only business of The Sheffer Corporation is the manufacture of "Muscles of Automation" pneumatic and hydraulic cylinders and linear decelerators. On the pages of this bulletin, we have given a brief description of each of our cataloged product lines. A complete bulletin including dimensions, variations, construction details, engineering and application data, and factory.
- In addition to our cataloged lines, we have the capability and willingness to produce special cylinders to meet your unusual or exacting requirements. Please do not hesitate to request a quotation. Whether special or standard, you will be pleased to discover that our prices are fair and our quality unexpower requirements in the near future.
- The Sheffer Corporation, located in Cincinnati, Ohio, markets its diverse lines of pneumatic and hydraulic cylinders through a network of distributors who are fluid power experts. They are located in every industrial area of the sign and responsibility. For the distributor nearest you, consult the back cover of this bulletin or the Yellow Pages of your telephone directory.

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- For years there has been a demand for a hydraulic cylinder piston that exhibited the long life of cast iron rings, the leak-tight sealing of cup seals, and the low friction of Teflon. A piston that would tolerate considerable side-loading without galling or scoring the tube; that would permit easy, but infrequent, maintenance, and would be economically feasible. A near perfect piston for virtually any application. The Sheffer SLIPPER SEAL PISTON meets these requirements to a degree that is astounding. It is now standard on the HH Series and will be available on other series of hydraulic cylinders in the near future.
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- Sheffer cylinders have either four wrench flats or spanner holes at rod end. This makes it easy for your workmen to install or perform maintenance without damaging the fine hard chrome surface of the piston rod.



## SHEFFER

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- All dynamic seals are pressure actuated and self-adjusting to wear.
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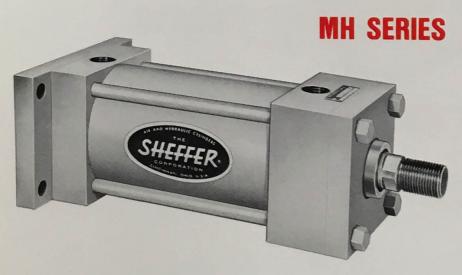
## SHEFFER® HYDRAULIC

#### **CLH SERIES**



 The Sheffer CLH Series, also described on page 6 as a pneumatic cylinder, is designed for hydraulic service up to 1500 PSI. Its compact design and heavy duty construction make it ideal for tooling and automation applications. 11/8" bore-heads only 1%" square. 1", 2", 3" and 4" strokes available from stock. Fractional and longer strokes available on short notice. Rear flange, front flange, side, clevis, pivot and stud mountings.

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Ten bore sizes from 1½" to 8" for medium pressure hydraulic service. Up to 2000 psi depending on bore size. Sheffer tapered cushions available for either or both ends. Dimensionally interchangeable, with 20 mounting styles and a wide variety of rod diameters. True hydraulic construction with multi-lip, no-leak, rod packings. The rod cartridge containing the rod seals and wiper is externally removable. Standard commercial, cataloged packings. Four wrench flats. Case hardened, hard chrome plated piston rods are standard for most sizes.

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### **HH SERIES**



 High pressure hydraulic cylinders made with machine tool precision and accuracy. 11/8" to 24" bore sizes. Rated at 3000 psi working pressure, up to 5000 maximum shock pressure. Interchangeable with 18 mounting styles. Externally removable multi-lip rod packings, self-compensating for wear. No-leak design throughout. New "no metal to metal", long life, low friction Slipper Seal piston! Rugged construction with top quality materials. Also available as the HA series for high pressure air service to 750 psi. NPT ports are standard; straight thread ports at no extra cost.

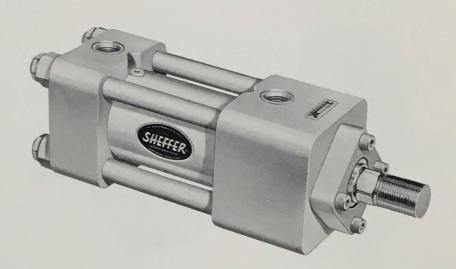
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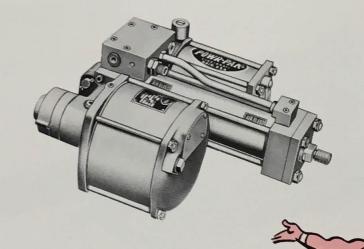
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#### PP SERIES

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## SHEFFER®

## **PNEUMATIC**

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 ¾" through 2½" Clamp Type Air Cylinders. Double Acting and Spring Return models. Many strokes available from stock. Fractional or non-stock strokes available on short notice. Tie Rod construction. Extremely short overall length. Universal mount or mounting kits for all applications. Piston rods super-finished stainless steel or hard chrome plated steel. Special alloy, hard anodized aluminum tubes. Self-adjusting rod and piston packings. 150 psi air with adequate safety factor.

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A complete line of 250 psi air cylinders. 11/8" to 14" bore sizes. Finest of the "interchangeables." Adjustable cushions. Four wrench flats. Removable rod cartridge without disassembly of the cylinder. Cylinder tubes are high-tensile aluminum alloy with a hard anodize finish. This, combined with pre-lubricated seals, produces a low-friction cylinder that will give excellent service for the life of the seals without adding lubrication. Larger bore sizes have seamless hard drawn brass tubes supplied to Sheffer tolerances. Select from 19 mountings and a wide variety of rod sizes. Most sizes of piston rods are high tensile steel, case hardened and hard chrome plated.

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## CYLINDERS With a complete line of accessories for each cylinder series.

#### **C20 SERIES**

● Economically priced, double acting, Air Cylinders for 150 psi. 10 Bore sizes from 1½" to 8".Rugged, simple, extremely compact. Available as non-cushioned, cushioned either end, or cushioned both ends. Intermediate Trunnion, Front Flange, Rear Flange, Clevis and Foot mountings. Double rod end configurations are also cataloged. NPT ports. All packings are standard commercial, cataloged packings.

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With the new Sheffer S.A.F.E. (Self-Aligning Flange End) Coupling, close radial alignment between cylinder rod end and machine member is easily and quickly achieved. Thus, cylinder installation is faster and cylinder life longer.

Because correct alignment means less wear of component parts, Sheffer S.A.F.E. Coupling allows for radial misalignment without causing abnormal rod bearing wear, short seal life, or possible damage to the I.D. of the cylinder tube. It is not designed, however, to compensate for axial misalignment. For this problem, ask your distributor about the Sheffer UNI-LIGN mounting accessory.

The S.A.F.E. Coupling also assures a stronger connection between rod end and machine member than a threaded rod end. The flat rod end takes the full load on the push stroke, and the machined shoulder of the rod end and the S.A.F.E. Coupling take the maximum loading force that the cylinder is capable of producing on the pull stroke.

The flange is made from solid steel, black oxide and chrome finished. High tensile, socket head cap screws, designed to take full loading with a safety factor, are provided. S.A.F.E. Coupling is for use with Sheffer Style 6 rod ends, available at no extra cost, and is available for immediate delivery.

Also available, as a convenient accessory (optional at extra cost), is a Weld Plate to match each S.A.F.E. Coupling, for customers who prefer to weld a pre-drilled and tapped, properly sized plate to the machine member.

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The Ross product line is divided into different Series or Families. Each has its own design characteristics and construction. The Family design concept offers many advantages in its standardization of design. If you standardize on a valve Family, many of the valves in the system can be serviced with common parts. For example: one sub-assembly in reserve can back up several valves of the same size and Family — for they all use the same sub-assembly.

#### ROSS MINUTE MAN — means IMMEDIATE DELIVERY

Well over one hundred Ross Products listed in this catalog are designated as MINUTE MAN items. Selecting from products in this category means immediate — off the shelf-delivery from your local Ross Representative or from our Detroit factory.

Model numbers appearing in a light grey rectangle indicates that the product is a MINUTE MAN item. Solenoid Operated MINUTE MAN Valves are available for 115 Volt, 60 Hertz service only. Other voltages and frequencies are available, but not with immediate delivery.

#### EXAMPLE

		MODEL NUMBERS		OVERALL DIMENSION (mm	
PIPE SIZE	NORMALLY CLOSED	NORMALLY OPEN	A	(mm) C	
1/4" 3/8" 1/2"	2771A2001 2771A3001 2771A4011	2772A2001 2772A3001 2772A4011	3.6 (91)	6.7 (170)	3.0 (76)
1/2" 3/4" 1"	2771A4001 2771A5001 2771A6011	2772A4001 2772A5001 2772A6011	4.6 (117)	7.3 (185)	3.0 (76)
1" 1¼" 1½"	2771A6001 2771A7001 2771A8011	2772A6001 2772A7001 2772A8011	6.6 (168)	10.1 (257)	4.1 (104)

#### WARRANTY

WARRANTY: With respect to the products sold hereunder, Ross warrants that the products shall be of the standard quality of Ross products. However, Ross makes no other warranty of any kind, express or implied, nor does Ross authorize any other person to make any other warranty, nor shall Ross be obligated or liable under any other guaranty or warranty, whether express or implied, or arising by virtue of law or otherwise. The obligation of Ross under this warranty is subject to the other provisions of this Paragraph and is limited exclusively to replacing any part or parts of the products sold hereunder which shall, in the opinion of Ross, be defective; provided that in lieu of replacing any defective part or parts, Ross may, in its sole discretion, allow Purchaser credit for the purchase price of the defective part or parts. Ross expressly disclaims any warranty with respect to its products meeting the provisions of the Occupational Safety and Health Act of 1970, and only upon receiving from buyer, prior to purchase, written explanation of specific use for products covered hereby can Ross consider any determination to the contrary. Ross' responsibility for products furnished by Ross shall be limited to the amount of the contract price with respect thereto to be paid by Purchaser to Ross hereunder. Ross shall in no event be liable for any further claims, labor expenses or damages (whether direct or consequential) resulting from any defects or any other acts or omissions of Ross of the Purchaser of such Ross products and only to the extent above expressed. EXCEPT AS SET FORTH IN THIS PARAGRAPH, ROSS MAKES NO WARRANTIES EITHER EXPRESS OR IMPLIED WITH RESPECT TO THE PRODUCTS COVERED BY THIS CONTRACT AND NO STATEMENT OF ANY REPRESENTATIVE OF ROSS SHALL EXTEND THE LIABILITY OF ROSS AS ESTABLISHED AND LIMITED BY THIS PARAGRAPH.

### STANDARD SPECIFICATIONS

#### CONTENTS

The products in this catalog meet specifications established by Joint Industry Conference (JIC).

#### SOLENOIDS

 Standard solenoids are rated for continuous duty, class "A" service, and operate at plus 5% to minus 15% of rated voltage within the standard air pressure range specified.

#### **Standard Voltages:**

- 100, 115, 120, 200, 230, 460, Volt A.C. 60 HZ
- 100, 110, 200, 220 Volt A.C. 50 HZ
- 24 and 110 Volt D.C.

Solenoids and coils are available, on special order, in a wide selection of other voltages and frequencies. Solenoids for excess moisture or high heat conditions can be furnished. Consult your Ross Representatives or Ross Operating Valve Company.

An electric quick disconnect receptacle is located between the valve body and base of all Series 70, 71 and 72 solenoid operated models. Black wire leads connect solenoid "B" and white leads to solenoid "A".

#### **FLOW MEDIA**

The Standard Specifications for each valve indicates the minimum and maximum pressure, ambient/media temperature and lubrication requirements. The Series 70, Series 72 and most of the Headline Series may be used in filtered air systems with or without an air line lubricator. The Series 71, Colt Series, and certain models of the Headline Series and Double Valves requires filtration and lubrication. For dry air conditions, consult your Ross Representative, or Ross Operating Valve Company.

#### **Temperature**

	Ambient	Media
	(Max.)	(Max.)
<ul> <li>Solenoid Valves</li> </ul>	120°F (49°C)	175°F (80°C)
All Other Valves	175°F (80°C)	175°F (80°C)
<ul> <li>Filters, Lubricators</li> </ul>		
Plastic Bowl	130°F (54°C)	130°F (54°C)
Metal Bowl	200°F (93°C)	200°F (93°C)
<ul> <li>Regulators</li> </ul>	180°F (82°C)	180°F (82°C)
• Minimum Ambient/I	Media Temperature	: 40°F (4°C)

#### PIPE THREADS

• Female, American Standard taper: ANSI B2.1.

#### **DIMENSIONS**

 $\bullet$  Product dimensions are given in one place decimal numbers, which may vary but generally within  $\pm$  0.1.

#### VALVE FLOW COEFFICIENTS

 The Cv values listed in this catalog are nominal. For precise Cv values consult your Ross Representatives or Ross Operating Valve Company.

Adaptable for other uses and conditionally suitable for other flow media. Consult your Ross Representative or Ross Operating Valve Company.

SINGLE SOLENOID OPERATED	PAGE NO
2-WAY 3-WAY 4-WAY  DOUBLE SOLENOID OPERATED	. 12, 13, 14 . 5, 7, 9, 11 12, 13
3-WAY	14
4-WAY — 2 POSITION	.5, 7, 9, 11
4-WAY — 3 POSITION	. 6, 8, 10
SINGLE AIR OPERATED	
2-WAY	. 23, 27
DOUBLE AIR OPERATED 4-WAY — 2 POSITION	19 20 26
4-WAY — 3 POSITION	19, 20
AIR OPERATED — TIMED SEQUENCE TYPE 2-WAY 3-WAY 4-WAY	. 24, 25
SPECIALTY VALVES	
DOUBLE VALVES HANDSAVER VALVE 3-WAY 4-WAY INFINITE DELAY L-O-X VALVE	. 27 . 27 . 27
MANUALLY OPERATED	
2-WAY 3-WAY 4-WAY — 2 POSITION	28 29
CAM OPERATED	
2-WAY 3-WAY 4-WAY	31
SELF OPERATED	
SPEED CONTROL — CHECK SHUTTLE	
FILTERS—REGULATORS—LUBRICATORS	
COMBINATIONS	36, 37, 38
MUFFLERS	39



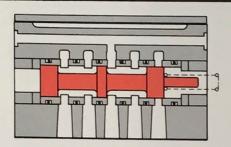
### ROSS

#### POPPET AND SPOOL VALVES

Recognizing that industrial applications and requirements vary, and pneumatic systems are becoming more complicated and sophisticated — Ross continually is expanding its product line. Industrial pneumatic valves generally can be divided into two types of construction — Poppet and Spool. Experience has shown that both types of construction give superior service under the most adverse operating conditions. Ross offers a broad line of directional control and accessory valves in Spool and Poppet construction.

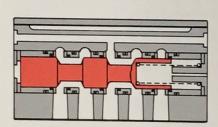
Select models for 2-way, 3-way or 4-way functions — two or three position — Inline — Base or Manifold mounted, with pipe port sizes ranging from  $\frac{1}{8}$ " through  $\frac{21}{2}$ ". Operate the valve with a maintained or momentary electric or remote air signal, or choose from manual or mechanical operators.

Consult Ross for all your pneumatic needs!



#### SERIES 70 - METAL TO METAL SPOOL CONSTRUCTION

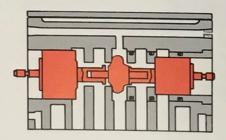
The heart of this Series of 4-way valves is the "Spool and Sleeve" valving element. These matched valving elements are hardened stainless steel, precision finished. Minimum movement of the balanced spool and ample fluid passages contribute to rapid valve response and high flow, and a minimum of pressure drop. Available in 2 or 3 position models.



#### SERIES 71 - RESILIENT SEAL SPOOL CONSTRUCTION

The moving valve element in the Series 71 is a polished high strength aluminum alloy spool, specially treated to reduce break-away and running friction. Spool is supported by Buna N Seals. Ample land length and resilient seals assures zero leakage between ports. The 4-way valve function in this Series is available in two position or three position flow patterns.

The above features pertain to this Series which uses the same bases as the Series 70 and 72.

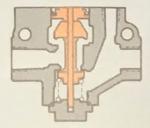


#### SERIES 72 - POPPET CONSTRUCTION

The simplicity of poppet construction is reflected in this Series. The corrosion resistant and resilient materials used in the moving elements of the Series 72 assures positive seal between ports and long, trouble-free life. The short movement of valving elements and large fluid passages contribute to rapid valve response and high flow, with a minimum pressure drop. This 4-way poppet valve includes all of the above features and utilizes the same base as the Series 70 and 71.

#### SERIES 70, 71 and 72 FEATURES

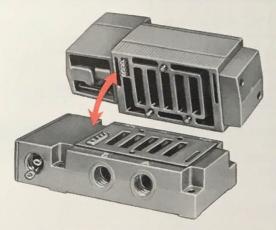
- Electric quick disconnect between valve body and base on all solenoid operated models.
- Signal port connection(s) in base on all remote air operated models.
- A selection of three style bases with provisions in the base for all electrical and air connections — Side Ported Base — Side and Bottom Ported Base — Single Station Manifold Base.
- Quick, easy removal of valve from base.



### HEADLINE SERIES - POPPET CONSTRUCTION

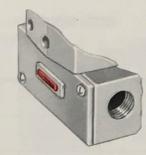
The poppet construction of the Series of Inline Mounted valves is built around a pressure assist seal principle — "the higher the pressure the tighter the seal." This construction passes many undesirable air line contaminants. In this design a minimum of close tolerance in moving parts is required. The travel of all moving parts is extremely small, consequently seal wear is reduced to a minimum and life expectancy of the valve is extended.

## ELECTRIC QUICK DISCONNECT — STANDARD ON ALL SOLENOID MODELS



**SIMPLIFIES INSTALLATION.** Sufficient tuck space in splash-proof junction box with two conduit openings — an integral part of all solenoid bases.

**SIMPLIFIES MAINTENANCE.** Removing valve from base breaks electrical connection to solenoid — no wires to disconnect.



#### INDICATOR LIGHTS

An accessory that lights up when electric power is applied to the solenoid (250 volt maximum). Optional on either single or double solenoid models.





#### MANUAL OVERRIDE

A choice of locking type or non-locking extended button type manual override is optional for single or double solenoid models.

#### **HEADLINE SERIES**

The head and body concept of the Headline permits the insertion of an adaptor between the valve operator and main body to perform actions not attainable with conventional valves.



#### AIR INDEX ADAPTOR

The valve shifts on receipt of an impulse signal and retains established flow pattern. The next impulse signal causes the valve to reverse and stay.



#### SOLENOID SEQUENCE ADAPTOR

Allows time delay of solenoid valves with a pneumatic timer. The main valve shifts after applying or exhausting pilot signal. Adjustable delay period 0 to 3 seconds.



#### "PB" ADAPTOR

Permits main valve operation with lower signal pressure.



"Q" ADAPTOR

Interposed pilot for extending time delays up to 60 seconds when used in conjunction with sequence adaptor.

#### SOLENOID PILOT OPERATED **SPRING RETURNED**



#### VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



#### **MODEL NUMBERS — VALVE LESS BASE**

NOM. PIPE SIZE W/BASE		MANUAL NON Locking	LOCKING		*OVERAL ENSIONS B	
2	3/8"-1/2"	7076A3301	7076A3305	2.6 (66)	3.5 (89)	7.3 (185)
4	1/2"-3/4"	7076A4301	7076A4305	3.0 (76)	3.5 (89)	8.1 (206)
8	1"-11/4"	7076A6301	7076A6305	4.1 (104)	3.5 (89)	9.8 (249)

#### OPERATION (When mounted on a base)

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, outlet B exhausted via FB.

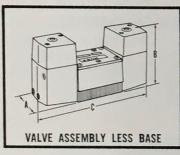
SOLENOID ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.



\*FOR NON-LOCKING MANUAL OVERRIDE ONLY

FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

#### **DOUBLE SOLENOID PILOT OPERATED** MOMENTARY WITH DETENT

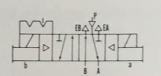


2	3/8"-1/2"	7076A3309	7076A3323	2.6 (66)	3.5 (89)	8.8 (224)
4	1/2"-3/4"	7076A4309	7076A4323	3.0 (76)	3.5 (89)	9.7 (247)
8	1"-11/4"	7076A6309	7076A6323	4.1 (104)	3.5 (89)	11.6 (295)

#### OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P open to outlet A, outlet B exhausted via EB.

SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P open to outlet B, outlet A exhausted via EA.



FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

#### STANDARD SPECIFICATIONS **OPERATOR**

SOLENOID: A.C. or D.C. power, continuous duty. POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding on 60 (50) Hz., 14 watts nominal on D.C.

ELECTRICAL CONNECTION: Quick disconnect between body and base, conduit opening and tuck space in base.

PILOT PRESSURE: Internal supply.

VALVE TO BASE MOUNTING BOLTS AND GASKET

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 kp/cm<sup>2</sup>). MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

PROVIDED WITH EACH VALVE ASSEMBLY. BASE NUMBERS SIDE PORTED BASE SIDE AND BOTTOM PORTED BASE \*MANIFOLD BASE DIMENSIONS (mm) PIPE BASE DIMENSIONS (mm) NOMINAL BASE DIMENSIONS (mm) BASE SIZE NUMBERS A B NUMBERS GV A B NUMBERS C C 6.9 3/8" 158K91 3.6 1.5 173K91 3.6 1.7 6.9 165K91 2.80 2.7 8.4 2 159K91 (91)(38)(175)174K91 1/2" (91) (43)(175)166K91 (71,1)(213)(69)1.7 7.7 160K91 3.8 175K91 1/2" 3.8 2.0 7.7 167K91 3.12 90 3.1 4 (196)3/4" 161K91 (97)(43)176K91 (97)(51)(196)168K91 (79.2)(229)(79)162K91 4.8 2.4 10.6 1" 8 (122)(61)(269)13/4" 163K91

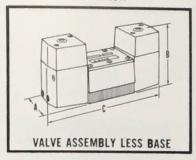
<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.

#### **DOUBLE SOLENOID PILOT OPERATED — 3 POSITION** SPRING CENTERED — ALL PORTS CLOSED



METAL TO METAL SPOOL CONSTRUCTION

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



NOM.		MANUAL OVERRIDE			OVERAL	
UV	W/BASE	LOCKING	LOCKING	A	В	C
2	3/8"-1/2"	7077A3301	7077A3305	2.6 (66)	3.5 (89)	8.8 (224)
4	1/2"-3/4"	7077A4301	7077A4305	3.0 (76)	3.5 (89)	9.7 (247)
8	1"-11/4"	7077A6301	7077A6305	4.1 (104)	3.5 (89)	11.9 (302)

MODEL NUMBERS — VALVE LESS BASE

MANUAL OVERRIDE ONLY \*FOR NON-LOCKING

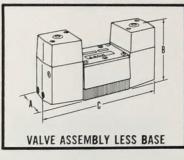
OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

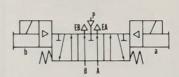
BOTH SOLENOIDS DE-ENERGIZED: All ports closed.

SOLENOID "b" ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.

#### **DOUBLE SOLENOID PILOT OPERATED — 3 POSITION** SPRING CENTERED — CYLINDER PORTS OPEN TO EXHAUST



2	3/8"-1/2"	7077A3309	7077A3323	2.6 (66)	3.5 (89)	8.8 (224)
4	1/2"-3/4"	7077A4309	7077A4323	3.0 (76)	3.5 (89)	9.7 (247)
8	1"-11/4"	7077A6309	7077A6323	4.1 (104)	3.5 (89)	11.9 (302)



OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH SOLENOID DE-ENERGIZED: Inlet P closed, outlet A ex-

hausted via EA, and outlet B exhausted via EB.

SOLENOID "b" ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.

#### STANDARD SPECIFICATIONS **OPERATOR**

SOLENOID: A.C. or D.C. power, continuous duty.

POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding on 60 (50) Hz., 14 watts nominal on D.C.

ELECTRICAL CONNECTION: Quick disconnect between body and base, conduit opening and tuck space in base.

PILOT PRESSURE: Internal supply.

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 kp/cm²).

MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

VALVE TO BA PROVIDED V	VITH EACH	TING BOLTS AND GA VALVE ASSEMBLY.	SKET		B					A			B
NOMINAL	PIPE	SIDE I BASE	PORTED DIM	BASE ENSIONS		SIDE AND BO		ORTED BA		*MAI BASE NUMBERS	NIFOLD B	ASE ENSIONS B	(mm)
CV	SIZE	NUMBERS	A	В	С	NUMBERS			6.9	165K91	2.80	2.7	8.4
2	3/8"	158K91 159K91	3.6 (91)	1.5 (38)	6.9 (175)	173K91 174K91	3.6 (91)	1.7 (43)	(175)	166K91	(71,1)	(69)	(213)
4	1/2"	160K91	3.8 (97)	1.7 (43)	7.7 (196)	175K91 176K91	3.8 (97)	2.0 (51)	7.7 (196)	167K91 168K91	3.12 (79,2)	3.1 (79)	9.0 (229)
	3/4"	161K91 162K91	4.8	2.4	10.6		-	_	-	_	-	-	_

<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.

(269)

(61)

(122)



8

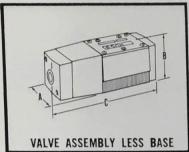
6

#### SOLENOID DIRECT OPERATED SPRING RETURNED

#### SERIFS METAL TO METAL SPOOL CONSTRUCTION

#### MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



NOM.	PIPE SIZE	NON	OVERRIDE		OVERAL NSIONS	
Cv	W/BASE	LOCKING	LOCKING	A	В	C
1	1/4"-3/8"	7016A2311	7016A2315	2.0 (51)	2.2 (56)	6.7 (170)
2	3/8"-1/2"	7016A3301	7016A3305	2.6 (66)	2.5 (64)	8.1 (206)
4	1/2"-3/4"	7016A4301	7016A4305	3.0 (76)	2.5 (64)	9.1 (311)
8	1"-11/4"	7016A6301	7016A6305	4.1 (104)	3.0 (76)	12.5 (320)

FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

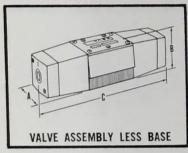
\*FOR NON-LOCKING MANUAL OVERRIDE ONLY

OPERATION (When mounted on a base)

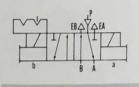
SOLENOID DE-ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

SOLENOID ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.

#### DOUBLE SOLENOID DIRECT OPERATED MOMENTARY WITH DETENT



1	1/4"-3/8"	7016A2319	7016A2333	2.0 (51)	2.2 (56)	8.5 (216)
2	3/8"-1/2"	7016A3309	7016A3323	2.6 (66)	2.5 (64)	10.7 (272)
4	1/2"-3/4"	7016A4309	7016A4323	3.0 (76)	2.5 (64)	11.5 (292)
8	1"-11/4"	7016A6309	7016A6323	4.1 (104)	3.0 (76)	17.1 (434)



FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P open to outlet A, outlet B exhausted via EB.

SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P open to outlet B, outlet A exhausted via EA.

#### STANDARD SPECIFICATIONS **OPERATOR**

SOLENOID: A.C. power, continuous duty.

POWER CONSUMPTION:

Nom. Cv	1	2	4	8
Inrush	76 VA	320 VA	345 VA	1092 VA
Holding	26 VA	58 VA	58 VA	118 VA
CYCLE RATE	Ξ:			
Nom. Cv Maximum	1 250CPM	2 275CPM	4 120CPM	8 60CPM

ELECTRICAL CONNECTION: Quick disconnect between body and base, conduit opening and tuck space in base. AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

BODY

PRESSURE RANGE: Filtered compressed air 0-150 psig (0-10 kp/cm2). MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

PROVIDED W  BJ  NUM  NOMINAL	SE MOUNT ITH EACH V  ASE IBERS  PIPE SIZE	*	PORTED E		(mm)	SIDE AND BO BASE NUMBERS		ORTED BA			NIFOLD B	ASE	
Cv 1	1/4"	218K91 236K91	2.8 (71)	1.4 (36)	6.0 (152)	220K91 239K91	2.8 (71)	1.4 (36)	6.0 (152)	222K91 242K91	2.26 (57,4)	2.3 (58)	7.8 (198)
2	3/8"	158K91 159K91	3.6 (91)	1.5 (38)	6.9 (175)	173K91 174K91	3.6 (91)	1.7 (43)	6.9 (175)	165K91 166K91	2.80 (71,1)	2.7 (69)	8.4 (213)
4	1/2"	160K91 161K91	3.8 (97)	1.7 (43)	7.7 (196)	175K91 176K91	3.8 (97)	2.0 (51)	7.7 (196)	167K91 168K91	3.12 (79,2)	3.1 (79)	9.0 (229)
8	1" 1¼"	162K91 163K91	4.8 (122)	2.4 (61)	10.8 (274)		_	_			_	_	_

<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.

#### DOUBLE SOLENOID DIRECT OPERATED - 3 POSITION SPRING CENTERED-ALL PORTS CLOSED

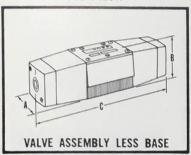
SERIES **METAL TO METAL** 

\*FOR NON-LOCKING MANUAL OVERRIDE ONLY

SPOOL CONSTRUCTION

MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



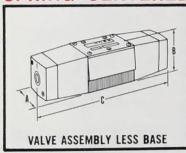
NOM.	PIPE SIZE W/BASE	MANUAI NON Locking	LOCKING		OVERAL	
0,	WIDAGE	LOUKING	LUCKING	A	В	C
1	1/4"-3/8"	7017A2311	7017A2315	2.0 (51)	2.2 (56)	8.5 (216)
2	3/8"-1/2"	7017A3301	7017A3305	2.6 (66)	2.5 (64)	10.7 (272)
4	1/2"-3/4"	7017A4301	7017A4305	3.0 (76)	2.5 (64)	11.6 (295)
8	1"-11/4"	7017A6301	7017A6305	4.1 (104)	3.0 (76)	17.2 (437)

OPERATION (When mounted on a base)

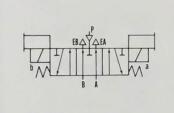
SOLENOID "a" ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH SOLENOIDS DE-ENERGIZED: All ports closed. SOLENOID "b" ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.

#### DOUBLE SOLENOID DIRECT OPERATED - 3 POSITION CENTERED - CYLINDER PORTS OPEN TO EXHAUST



	and the second second second					
1	1/4"-3/8"	7017A2319	7017A2333	2.0 (51)	2.2 (56)	8.5 (216)
2	3/8"-1/2"	7017A3309	7017A3323	2.6 (66)	2.5 (64)	10.7 (272)
4	1/2"-3/4"	7017A4309	7017A4323	3.0 (76)	2.5 (64)	11.6 (295)
8	1"-11/4"	7017A6309	7017A6323	4.1 (104)	3.0 (76)	17.2 (437)



OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

#### STANDARD SPECIFICATIONS **OPERATOR**

SOLENOID: A.C. power, continuous duty.

POWER CONSUMPTION:

8 2 Nom. Cv 1092 VA 320 VA 345 VA 76 VA Inrush 58 VA 118 VA 26 VA 58 VA Holding CYCLE RATE: 8 Nom. Cv 60CPM 120CPM 275CPM Maximum 250CPM

BOTH SOLENOID DE-ENERGIZED: Inlet P closed, outlet A exhausted via EA, and outlet B exhausted via EB.

SOLENOID "b" ENERGIZED: Inlet P open to outlet B,outlet A exhausted via EA.

ELECTRICAL CONNECTION: Quick disconnect between body and base, conduit opening and tuck space in base. AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

PRESSURE RANGE: Filtered compressed air 0-150 psig (0-10 kp/cm²).

MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

PROVIDED W	ASE MOUNT VITH EACH V ASE BERS	ING BOLTS AND GAI VALVE ASSEMBLY.	PORTED	BASE	B	SIDE AND BO	OTTOM PO	RTED BA	ASE (mm)		NIFOLD B		(mm)
NOMINAL	PIPE	BASE NUMBERS	A DIM	ENSIONS B	C	BASE NUMBERS	A	В	C	NUMBERS	A 2.26	B 2.3	7.8
1	1/4"	218K91	2.8 (71)	1.4 (36)	6.0 (152)	220K91 239K91	2.8 (71)	1.4 (36)	6.0 (152)	222K91 242K91	(57,4)	(58)	(198)
2	3/8"	236K91 158K91	3.6	1.5	6.9 (175)	173K91 174K91	3.6 (91)	1.7	6.9 (175)	165K91 166K91	2.80 (71,1)	2.7 (69)	8.4 (213)
4	1/2"	159K91 160K91	(91)	(38)	7.7 (196)	175K91 176K91	3.8 (97)	2.0 (51)	7.7 (196)	167K91 168K91	3.12 (79,2)	3.1 (79)	9.0 (229)
8	3/4" 1" 11/4"	161K91 162K91 163K91	(97) 4.8 (122)	(43) 2.4 (61)	10.8 (269)		-	-	-	— — — — — — — — — — — — — — — — — — —	_		- Polts

<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided and seals included with manifold for multiple station assembly.

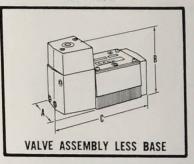


8

#### **SOLENOID PILOT OPERATED** SPRING RETURNED



#### VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



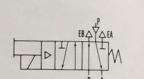
#### **MODEL NUMBERS** — VALVE LESS BASE

NOM.		MANUAL ( NON Locking	LOCKING	DIM	*OVERAL ENSIONS	
Cv	W/BASE	LUCKING	LOUKING	A	В	C
4	1/2"-3/4"	7176A4301	7176A4305	3.0 (76)	3.5 (89)	8.1 (206)
8	1"-11/4"	7176A6301	7176A6305	4.1 (104)	3.5 (89)	9.8 (249)

#### OPERATION (When mounted on a base)

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

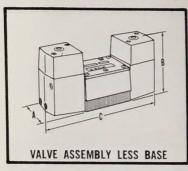
SOLENOID ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.



\*FOR NON-LOCKING MANUAL OVERRIDE ONLY

FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

#### **DOUBLE SOLENOID PILOT OPERATED MOMENTARY WITH DETENT**

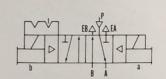


4	1/2"-3/4"	7176A4309	7176A4323	3.0 (76)	3.5 (89)	9.7 (247)
8	1"-11/4"	7176A6309	7176A6323	4.1 (104)	3.5 (89)	11.6 (295)

#### OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P open to outlet A, outlet B exhausted via EB.

SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P open to outlet B, outlet A exhausted via EA.



FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

#### STANDARD SPECIFICATIONS **OPERATOR**

SOLENOID: A.C. or D.C. power, continuous duty. POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding on 60 (50) Hz., 14 watts nominal on D.C.

163K91

11/4"

(122)

(61)

ELECTRICAL CONNECTION: Quick disconnect between body and base, conduit opening and tuck space in base.

PILOT PRESSURE: Internal supply.

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

PRESSURE RANGE: Filtered and lubricated compressed air 35-150 psig (2,5-10 kp/cm<sup>2</sup>). MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

VALVE TO BASE MOUNTING BOLTS AND GASKET PROVIDED WITH EACH VALVE ASSEMBLY. BASE **NUMBERS** SIDE PORTED BASE SIDE AND BOTTOM PORTED BASE \*MANIFOLD BASE DIMENSIONS (mm) DIMENSIONS (mm) NOM. PIPE BASE BASE BASE DIMENSIONS (mm) NUMBERS NUMBERS A B SIZE A Cv B C NUMBERS B C 1.7 1/2" 160K91 3.8 7.7 175K91 3.8 2.0 167K91 3.12 4 3.1 176K91 (97)9.0 (196)(51)(196)3/4" 161K91 (97)(43)168K91 (79,2)(79)(229)2.4 10.6 1" 162K91 4.8 8 (269)

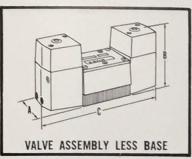
<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.

#### **DOUBLE SOLENOID PILOT OPERATED — 3 POSITION** SPRING CENTERED - ALL PORTS CLOSED

SERIES

**RESILIENT SEAL** SPOOL CONSTRUCTION

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



NOM.	PIPE SIZE W/BASE	MANUAL NON LOCKING	OVERRIDE		*OVERAL ENSIONS		
	WIDASE	LUCKING	LOCKING	A	В	C	
4	1/2"-3/4"	7177A4301	7177A4305	3.0 (76)	3.5 (89)	9.7 (247)	
8	1"-11/4"	7177A6301	7177A6305	4.1 (104)	3.5 (89)	11.6 (295)	

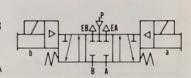
**MODEL NUMBERS — VALVE LESS BASE** 

OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

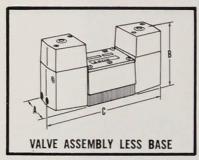
BOTH SOLENOIDS DE-ENERGIZED: All ports closed.

SOLENOID "b" ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.



\*FOR NON-LOCKING MANUAL OVERRIDE ONLY

#### **DOUBLE SOLENOID PILOT OPERATED — 3 POSITION** SPRING CENTERED — CYLINDER PORTS OPEN TO EXHAUST



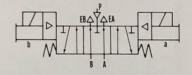
4	1/2"-3/4"	7177A4309	7177A4323	3.0 (76)	3.5 (89)	9.7 (247)
8	1"-11/4"	7177A6309	7177A6323	4.1 (104)	3.5 (89)	11.6 (295)

OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH SOLENOID DE-ENERGIZED: Inlet P closed, outlet A exhausted via EA, and outlet B exhausted via EB.

SOLENOID "b" ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.



#### STANDARD SPECIFICATIONS **OPERATOR**

SOLENOID: A.C. or D.C. power, continuous duty.

POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding

on 60 (50) Hz., 14 watts nominal on D.C.

ELECTRICAL CONNECTION: Quick disconnect between body and base, conduit opening and tuck space in base.

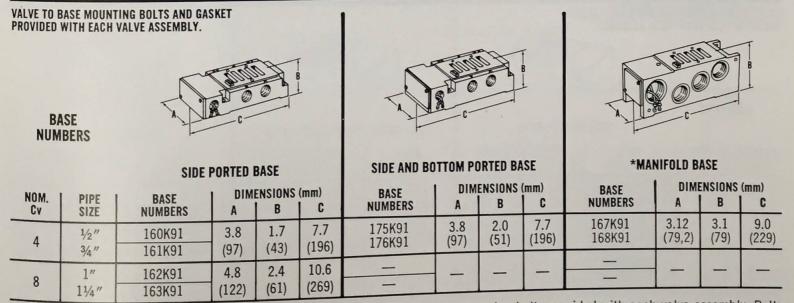
PILOT PRESSURE: Internal supply.

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

PRESSURE RANGE: Filtered and lubricated compressed air 35-150 psig (2,5-10 kp/cm<sup>2</sup>).

MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.



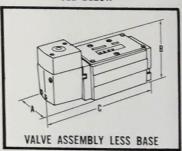
<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.



# SOLENOID PILOT OPERATED INTERNAL PRESSURE RETURNED



#### VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW



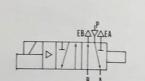
MODEL NUMBERS -	VALVE L	ESS BASE
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NOM.	PIPE SIZE	NON			*OVERAL	
Cv	W/BASE	LOCKING	LOCKING	A	В	C
2	3/8"-1/2"	7276A3301	7276A3305	2.7 (69)	3.6 (91)	7.9 (201)
4	1/2"-3/4"	7276A4301	7276A4305	3.1 (79)	3.6 (91)	8.5 (216)
10	1"-11/4"	7276A6301	7276A6305	4.1 (104)	3.6 (91)	10.3 (262)

#### OPERATION (When mounted on a base)

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, outlet B exhausted via EB.

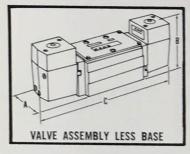
SOLENOID ENERGIZED: Inlet P open to outlet B, outlet A exhausted via EA.



\*FOR NON-LOCKING MANUAL OVERRIDE ONLY

FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM — SEE PAGE 1.

# DOUBLE SOLENOID PILOT OPERATED MOMENTARY WITH DETENT

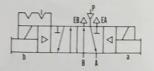


2	3/8"-1/2"	7276A3309	7276A3323	2.7 (69)	3.6 (91)	10.3 (262)
4	1/2"-3/4"	7276A4309	7276A4323	3.1 (79)	3.6 (91)	10.9 (277)
10	1"-11/4"	7276A6309	7276A6323	4.1 (104)	3.6 (91)	12.7 (323)

#### OPERATION (When mounted on a base)

SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P open to outlet A, outlet B exhausted via EB.

SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P open to outlet B, outlet A exhausted via EA.



FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

# STANDARD SPECIFICATIONS OPERATOR

SOLENOID: A.C. or D.C. power, continuous duty.
POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding

on 60 (50) Hz., 14 watts nominal on D.C.
ELECTRICAL CONNECTION: Quick disconnect between body

and base, conduit opening and tuck space in base.

PILOT PRESSURE: Internal supply.

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 kp/cm²).

MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

PROVIDED V		TING BOLTS AND GAVALVE ASSEMBLY.	SAE!		8		Sainti Room	0	- B				B
NOMINAL Cv	PIPE	BASE NUMBERS	PORTED DIMI	BASE ENSIONS B	(mm)	SIDE AND B Base Numbers		ORTED B Ensions B		*MA Base Numbers		ENSIONS	
2	3/8" 1/2"	158K91 159K91	3.6 (91)	1.5 (38)	6.9 (175)	173K91 174K91	3.6 (91)	1.7 (43)	6.9 (175)	165K91 166K91	2.80 (71,1)	2.7 (69)	8.4 (213)
4	1/2" 3/4"	160K91 161K91	3.8 (97)	1.7 (43)	7.7 (196)	175K91 176K91	3.8 (97)	2.0 (51)	7.7 (196)	167K91 168K91	3.12 (79,2)	3.1 (79)	9.0 (229)
10	1" 134"	162K91 163K91	4.8 (122)	2.4 (61)	10.6 (269)	_	_	-	_		-	_	_

<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.



PIPE	MODEL NU NORMALLY CLOSED	NORMALLY	1	OVERAL ENSION:	S (mm)	
SIZL	CLUSED	OPEN	A	В	C	
1/8″	1613A1020	1614A1020	2.6	3.5	2.6	NORMALLY CLOSED NORMALLY OPEN
1/4"	1613A2020	1614A2020	(66)	(89)	(66)	FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM — SEE PAGE 1.

OPERATION: Normally Closed.

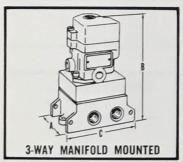
SOLENOID DE-ENERGIZED: Inlet P closed, outlet A exhausted

SOLENOID ENERGIZED: Inlet P open to outlet A, exhaust closed.

OPERATION: Normally Open.

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, exhaust closed.

SOLENOID ENERGIZED: Inlet P closed, outlet A exhausted via E.



1/8"	1613A1522	1614A1522	2.62	6.2	4.2	NORMALLY CLOSED
1/4"	1613A2522	1614A2522	-	(157)	(107)	NORMALLY OPEN

#### STANDARD SPECIFICATIONS

SOLENOID: A.C. or D.C. power, continuous duty. POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding on 60 (50) Hz., 14 watts nominal on D.C.

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max. PRESSURE RANGE: Filtered compressed air 5-150 psig (0,3-10 kp/cm2).

MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.



1/4"	1616A2020	2.6 (66)	4.5 (114)	3.1 (79)	
ODERATION.					FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM — SEE PAGE 1.

OPERATION

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, outlet B exhausted via E.

SOLENOID ENERGIZED: Inlet P open to outlet B, outlet A exhausted via E.



1/4"	1616A2522	2.62 6 (66,5) (1	5.2 4.2 57) (107)	
/4		(00,3)	57) (257)	E √ Åp

#### STANDARD SPECIFICATIONS

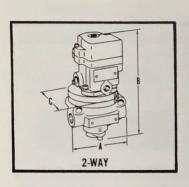
SOLENOID: A.C. or D.C. power, continuous duty. POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) VA Holding on 60 (50) Hz., 14 watts nominal on D.C.

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max. PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max. kp/cm²).

### SOLENOID PILOT OPERATED - 2, 3, AND 4-WAY SPRING RETURNED

HEADLINE SERIES

POPPET CONSTRUCTION INLINE MOUNTED



MODEL NUMBERS			OVERAL		
PIPE SIZE	NORMALLY CLOSED	NORMALLY OPEN	DIM A	ENSION B	(mm)
1/4" 3/8" 1/2"	2771A2001 2771A3001 2771A4011	2772A2001 2772A3001 2772A4011	3.6 (91)	6.7 (170)	3.0 (76)
1/2" 3/4" 1"	2771A4001 2771A5001 2771A6011	2772A4001 2772A5001 2772A6011	4.6 (117)	7.3 (185)	3.0 (76)
1" 1¼" 1½"	2771A6001 2771A7001 2771A8011	2772A6001 2772A7001 2772A8011	6.6 (168)	10.1 (257)	4.1 (104)
1½" 2" 2½"	2671A8001 2671A9001 2671A9011	2672A8001 2672A9001 2672A9011	8.6 (218)	11.5 (292)	5.1 (130)

NORMALLY OPEN

NORMALLY CLOSED

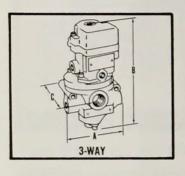
FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE

OPERATION: Normally Closed.

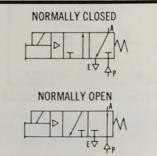
SOLENOID DE-ENERGIZED: Inlet P closed to outlet A. SOLENOID ENERGIZED: Inlet P open to outlet A.

OPERATION: Normally Open.

SOLENOID DE-ENERGIZED: Inlet P open to outlet A. SOLENOID ENERGIZED: Inlet P closed to outlet A.



	The second secon				
1/4"	2773A2001	2774A2001	2.0	0.0	2.1
3/8″	2773A3001	2774A3001	3.6	6.9	3.1
1/2"	2773A4011	2774A4011	(91)	(170)	(79)
1/2"	2773A4001	2774A4001	4.0	77	0.0
3/4"	2773A5001	2774A5001	4.6	7.7	3.6
1"	2773A6011	2774A6011	(117)	(196)	(91)
1"	2773A6001	2774A6001	0.0	10.1	
11/4"	2773A7001	2774A7001	6.6	10.1	4.8
11/2"	2773A8011	2774A8011	(168)	(257)	(122)
11/2"	2673A8001	2674A8001	0.0		
2"	2673A9001	2674A9001	8.6	12.1	6.3
21/2"	2673A9011	2674A9011	(218)	(307)	(160)



FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE

OPERATION: Normally Closed.

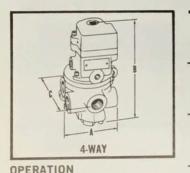
SOLENOID DE-ENERGIZED: Inlet P closed, outlet A exhausted via E.

SOLENOID ENERGIZED: Inlet P open to outlet A, exhaust closed.

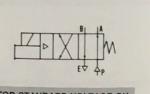
OPERATION: Normally Open.

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, exhaust closed.

SOLENOID ENERGIZED: Inlet P closed, outlet A exhausted via E.



2776A2001 2776A3001 2776A4011	3.9 (99)	6.9 (170)	3.8 (97)
2776A4001 2776A5001 2776A6011	4.4 (112)	8.7 (221)	5.2 (132)
2776A6001 2776A7001 2776A8011	6.5 (165)	10.4 (264)	8.1 (206)
	2776A3001 2776A4011 2776A4001 2776A5001 2776A6001 2776A6001 2776A7001	2776A3001 3.9 (99) 2776A4001 4.4 (112) 2776A6001 2776A6001 2776A7001 6.5	2776A3001 3.9 6.9 (99) (170) 2776A4001 4.4 8.7 (112) (221) 2776A6001 2776A7001 6.5 10.4



FOR STANDARD VOLTAGE ON A MINUTE MAN ITEM - SEE PAGE 1.

SOLENOID DE-ENERGIZED: Inlet P open to outlet A, outlet B exhausted via E.

#### STANDARD SPECIFICATIONS

#### **OPERATOR**

SOLENOID: A.C. or D.C. power, continuous duty.

POWER CONSUMPTION: 70 (50) VA Inrush, 18 (23) Holding on 60 (50) Hz., 14 watts nominal on D.C.

PILOT PRESSURE: Internal supply, convertible to external supply. Pilot pressure should be equal to main valve pressure but never less than 15 psig (1 kp/cm²).

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

exhausted via E.

PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 kp/cm²) with internal pilot pressure or 5-150 psig (0,3-10 kp/cm²) with external pilot pressure. MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

SOLENOID ENERGIZED: Inlet P open to outlet B, outlet A

## DOUBLE SOLENOID PILOT OPERATED - 3, AND 4-WAY MOMENTARY WITH DETENT

HEADLINE SERIES POPPET CONSTRUCTION

**INLINE MOUNTED** 

	-
2	_
	71
	10
	B
	_
3-WAY	

PIPE SIZE	MODEL NU Normally Closed	MBERS Normally Open		OVERAL Ensions B		
1/4" 3/8" 1/2"	2773A2003 2773A3003 2773A4013	2774A2003 2774A3003 2774A4013	7.6 (193)	5.9 (150)	3.1 (79)	NORMALLY CLOSED
<sup>1</sup> / <sub>2</sub> " <sup>3</sup> / <sub>4</sub> " 1"	2773A4003 2773A5003 2773A6013	2774A4003 2774A5003 2774A6013	7.6 (193)	6.7 (170)	3.6 (91)	NORMALLY OPEN
1" 1¼" 1½"	2773A6003 2773A7003 2773A8013	2774A6003 2774A7003 2774A8013	7.6 (193)	9.4 (239)	4.8 (122)	b T A A
		ODEDATI	ON N			

OPERATION: Normally Closed.

SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P closed, outlet A exhausted via E.

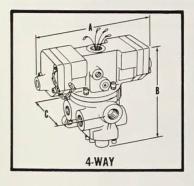
SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P open to outlet A, exhaust closed.

OPERATION: Normally Open.

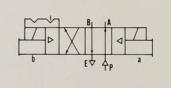
SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P open to outlet A, exhaust closed.

SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P closed.

outlet A exhausted via E.



1/4" 3/8" 1/2"	2776A2003 2776A3003 2776A4013	7.6 (193)	5.9 (150)	3.8 (97)
1/2" 3/4" 1"	2776A4003 2776A5003 2776A6013	7.6 (193)	7.7 (196)	5.2 (132)
1" 1½" 1½"	2776A6003 2776A7003 2776A8013	7.6 (193)	9.4 (239)	8.1 (206)



#### **OPERATION**

SOLENOID "a" ENERGIZED MOMENTARILY: Inlet P open to outlet A, outlet B exhausted via E.

SOLENOID "b" ENERGIZED MOMENTARILY: Inlet P open to outlet B, outlet A exhausted via E.

#### STANDARD SPECIFICATIONS

#### **OPERATOR**

SOLENOID: A.C. power, continuous duty.

POWER CONSUMPTION: 78 (60) VA Inrush, 18 (23) VA Holding on 60 (50) Hz.

PILOT PRESSURE: Internal supply, convertible to external supply. Pilot pressure should be equal to main valve pressure but never less than 30 psig (2 kp/cm²).

AMBIENT TEMPERATURE: 40°F (4°C) min., 120°F (49°C) max.

#### BODY

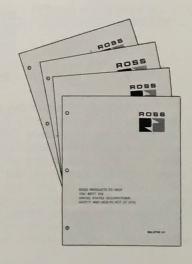
PRESSURE RANGE: Filtered and lubricated compressed air 30-150 psig (2-10 kp/cm<sup>2</sup>) with internal pilot pressure or 5-150 psig (0,3-10 kp/cm²) with external pilot pressure. MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

AVAILABLE WITH D.C. PILOT - CONSULT YOUR ROSS REPRE-SENTATIVE.

#### LITERATURE AVAILABLE IN OTHER LANGUAGES

Digest Catalogs and Service Data Sheets on most Ross Products are available in several languages - Contact your local Ross Representative or Ross Operating Valve Company.



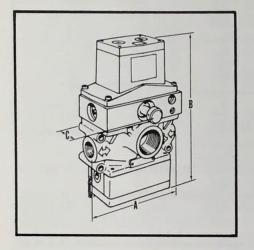




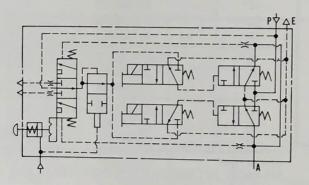
# DOUBLE VALVE - PARALLEL FLOW WITH LIFEGUARD® II PNEUMATIC LOCKOUT

Two separate 3-way normally closed valve elements designed into a common body. Each valve element is operated by its own normally closed solenoid pilot. The

LIFEGUARD monitoring device is designed to sense a malfunction of either one of the two main valve elements and shuts the valve down when such a condition occurs.



PIPE	MODEL NUMBERS	OVERALL DIMENSIONS (mm)					
SIZE		A	В	C			
3/8"	3573A3004	6.1	10.1	4.8			
1/2"	3573A4014	(155)	(257)	(122)			
3/4"	3573A5004	6.4	10.7	4.8			
1"	3573A6014	6.4 (163)	(272)	(122)			
11/4"	3573A7004	10.2	14.5	4.9			
11/2"	3573A8014	(259)	(368)	(124)			



**OPERATION:** BOTH SOLENOIDS DE-ENERGIZED SIMULTANE-OUSLY — Input P closed, outlet A exhausted via E. BOTH SOLENOIDS ENERGIZED SIMULTANEOUSLY — Input P open to outlet A, exhaust closed.

#### STANDARD SPECIFICATIONS

**OPERATOR:** SOLENOID — A.C. or D.C. power, continuous duty. POWER CONSUMPTION — 70 (50) VA inrush, 18 (23) VA holding (each solenoid) on 60 (50) Hz., 14 Watts (each solenoid) on D.C. STANDARD VOLTAGES — 115 volt 60 Hz., 24 and 110 volt D.C. AMBIENT TEMPERATURE RANGE —; 40°F to 120°F (4°C to 49°C).

**BODY:** PRESSURE RANGE — Filtered and lubricated compressed air 30 to 150 psig (2 to 10 kp/cm²). MEDIA TEMPERATURE RANGE —; 40°F to 175°F (4°C to 80°C).

NOTE: Improperly sized upstream and/or downstream pneumatic components, can adversely affect the performance of a Double Valve.

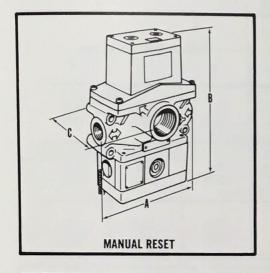
The two 3-way normally closed main valve elements are situated side by side in a common body. Air entering the inlet port is divided, part of the air passing through one valve element, the remainder through the second element. Should either valve element malfunction during a normal cycle, the valve's large exhausting capacity is designed to override the effect of the inlet pressure. Due to this large exhausting capacity a high pressure drop is created which quickly reduces the outlet pressure to approximately 5% of the inlet pressure.

The LIFEGUARD II, installed between the main valve body and the two solenoid pilots, is designed to monitor the pressure in the two outlet chambers of the parallel flow double valve. In normal operation, this sensing device permits pilot air to pass to the two solenoid pilots. The LIFEGUARD II monitor is so arranged that a malfunction of either one of the two elements tends to cause a pressure imbalance within the device. This monitoring device is designed to shift when an a shifted and locked position, it is necessary to re-set the LIFEGUARD II before another cycle can be initiated.

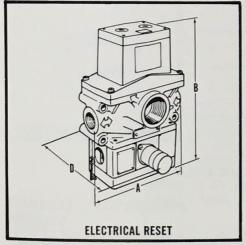
# DOUBLE VALVE — PARALLEL FLOW WITH ELECTRO-PNEUMATIC LOCKOUT

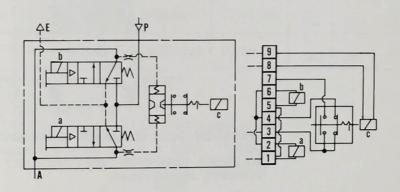
Two separate 3-way normally closed valve elements designed into a common body. Each valve element is operated by its own normally closed solenoid pilot. The ELECTRO-PNEUMATIC monitoring device is designed to

sense a malfunction of either one of the two main valve elements and open the electric circuit when such a condition occurs, thus shutting the valve down.



PIPE	MODEL N Manual	IUMBERS   ELECTRICAL	0	VERALL DIM	nm)	
SIZE	RESET	RESET	A	В	C	D
3/8"	3573A3003	3573A3002	6.1	9.7	3.4	4.9
1/2"	3573A4013	3573A4012	(155)	(246)	(86)	(124)
<sup>3</sup> / <sub>4</sub> " 1"	3573A5003	3573A5002	6.4	10.9	4.0	4.9
	3573A6013	3573A6012	(163)	(277)	(102)	(124)
1½"	3573A7003	3573A7002	10.2	14.8	4.9	4.9
1½"	3573A8013	3573A8012	(259)	(376)	(124)	(124)





**OPERATION:** BOTH SOLENOIDS DE-ENERGIZED SIMULTANE-OUSLY — Input P closed, outlet A exhausted via E. BOTH SOLENOIDS ENERGIZED SIMULTANEOUSLY — Input P open to outlet A, exhaust closed.

#### STANDARD SPECIFICATIONS

**OPERATOR** (Manual Reset): SOLENOID A.C. or D.C. power, continuous duty. POWER CONSUMPTION — 70 (50 VA inrush, 18 (23) VA holding (each solenoid) on 60 (50) Hz., 14 Watts (each solenoid) on D.C. STANDARD VOLTAGES — 115 volt 60 Hz., 24 and 110 volt D.C. AMBIENT TEMPERATURE RANGE —; 40° to 120°F (4°C to 49°C).

**OPERATOR** (Electrical Reset): Solenoid A.C. or D.C. power, continuous duty. POWER CONSUMPTION — 70 (50) VA inrush, 18

(23) VA holding (each solenoid) on 60 (50) Hz., 14 Watts (each solenoid) on D.C. Re-set solenoid — 17 VA inrush, 8 VA holding on 60 Hz., 4 Watts on D.C. STANDARD VOLTAGES — 115 Volt 60 Hz., 24 and 110 Volt D.C. AMBIENT TEMPERATURE RANGE —; 40°F to 120°F (4°C to 49°C).

**BODY:** PRESSURE RANGE — Filtered compressed air 30 to 150 psig (2 to 10 kp/cm²). MEDIA TEMPERATURE RANGE —; 40°F to 175°F (4°C to 80°C).

NOTE: Improperly sized upstream and/or downstream pneumatic components, can adversely affect the performance of a Double Valve.

The two 3-way normally closed main valve elements are situated side by side in a common body. Air entering the inlet port is divided, part of the air passing through one valve element, the remainder through the second element. Should either valve element malfunction during a normal cycle, the valve's large exhausting capacity is designed to override the effect of the inlet pressure. Due to this large exhausting capacity a high pressure drop is created which quickly reduces the outlet pressure to approximately 5% of the inlet pressure.

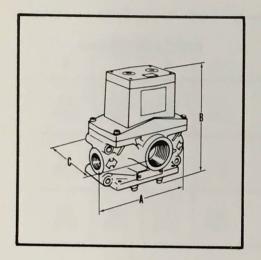
The ELECTRO-PNEUMATIC monitor is designed to sense the pressure in the two outlet chambers of the parallel flow double valve. In normal operation the electric circuit between solenoids and terminal strip is closed via momentary switch. The E-P monitor is so arranged that a malfunction of either one of the two elements tends to cause a pressure imbalance within the device. This device is designed to shift and open the electric circuit to the two solenoid pilots. The E-P monitor must be re-set before another cycle can be initiated.



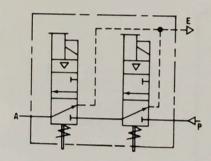
## **DOUBLE VALVE — SERIES FLOW WITH POSITION INDICATOR PINS**

The POSITION INDICATOR PINS provide a visual and mechanical means of monitoring the movement of the two 3-way normally closed main valve elements. By in-

corporating an appropriate control device, the system can be made to shut itself down if a malfunction occurs in either one of the two valve elements.



PIPE   MODEL NUMBERS		OVER	ALL DIMENSIO	NS (mm)
SIZE		A	В	C
3/8"	3573A3001	6.1	9.0	24
1/2"	3573A4011	(155)	(229)	3.4 (86)
3/4"	3573A5001	6.4	9.6	10
1/4"	3573A6011	6.4 (163)	(244)	4.0 (102)
11/4"	3573A7001	10.2	13.4	4.9
11/2"	3573A8011	(259)	(340)	(124)



**OPERATION:** BOTH SOLENOIDS DE-ENERGIZED SIMULTANE-OUSLY — Input P closed, outlet A exhausted via E. BOTH SOLENOIDS ENERGIZED SIMULTANEOUSLY — Input P open to outlet A, exhaust closed.

#### STANDARD SPECIFICATIONS

**OPERATOR:** SOLENOID — A.C. or D.C. power, continuous duty. POWER CONSUMPTION — 70 (50) VA inrush, 18 (23) VA holding (each solenoid) on 60 (50) Hz., 14 Watts (each solenoid) on D.C. STANDARD VOLTAGES — 115 volt 60 Hz., 24 and 110 volt D.C. AMBIENT TEMPERATURE RANGE —; 40°F to 120°F (4°C to 49°C).

**BODY:** PRESSURE RANGE — Filtered and lubricated compressed air 30 to 150 psig (2 to 10 kp/cm²). MEDIA TEMPERATURE RANGE —; 40°F to 175°F (4°C to 80°C).

NOTE: Improperly sized upstream and/or downstream pneumatic components, can adversely affect the performance of a Double Valve.

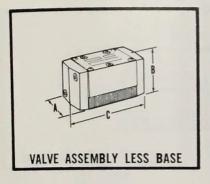
In the ROSS SERIES FLOW DOUBLE VALVE, two 3-way normally closed valve elements are combined in a common body. Air must first pass through one valve element before it can pass through the second element to enter the outlet passage. Two separate 3-way normally closed solenoid pilots provide the operating force — one for each valve element. Should either valve element close during a cycle, the air supply is shut off and the outlet pressure is quickly exhausted. Position Indicator Pins are pro-

vided to respond to the moving parts in each of the two main valve elements. These pins extend or retract as the valve elements open or close. Interlocking devices can be tied in externally to monitor the physical movement of the two main valve elements via the pins. The monitoring circuit should be designed to sense an asynchronous motion of the Position Indicator Pin and prevent further operation.



## MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW

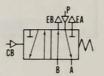


NOM.   PIPE SIZE   NO MANUAL			MANUAL NON				*OVERALL DIMENSIONS (mm)				
Cv	W/BASE	OVERRIDE	LOCKING	LOCKING	A	В	C				
2	3/8"-1/2"	7056A3301	7056A3305	7056A3303	2.6 (66)	2.5 (64)	5.7 (145)				
4	1/2"-3/4"	7056A4301	7056A4305	7056A4303	3.0 (76)	2.5 (64)	6.6 (168)				
8	1"-11/4"	7056A6301	7056A6305	7056A6303	4.1 (104)	2.5 (64)	8.0 (206)				

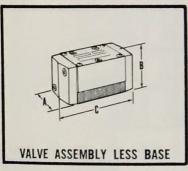
OPERATION (When mounted on a base)

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, outlet B exhausted via EB.

PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



### **DOUBLE AIR OPERATED** MOMENTARY WITH DETENT

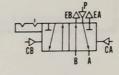


2	3/8"-1/2"	7056A3307	7056A3321	7056A3309	2.6 (66)	2.5 (64)	5.7 (145)
4	1/2"-3/4"	7056A4307	7056A4321	7056A4309	3.0 (76)	2.5 (64)	6.6 (168)
8	1"-11/4"	7056A6307	7056A6321	7056A6309	4.1 (104)	2.5 (64)	8.0 (206)

OPERATION (When mounted on a base)

outlet A exhausted via EA.

MOMENTARY PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB. MOMENTARY PILOT SIGNAL TO CB: Inlet P open to outlet B,



## STANDARD SPECIFICATIONS

**OPERATOR** 

PILOT SIGNAL: Filtered compressed air 15 psig (1 kp/cm²) Min., 150 psig (10 kp/cm²) Max.

SIGNAL PORT: Connection in base.

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

BODY

PRESSURE RANGE: Filtered compressed air 0-150 psig (0-10 kp/cm2).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

VALVE TO BA PROVIDED W	SE MOUNT ITH EACH \	ING BOLTS AND GAS VALVE ASSEMBLY.	KET							N. S.	dini		
	BASE NUMBERS SIDE PORTED BASE			SIDE AND BO	CTTOM PO	ORTED BA	ISE	*MAI	O O O C O NIFOLD B	ASE			
		SIDE					I DIM	ENSIONS	(mm)	BASE		ENSIONS	(mm)
NOMINAL	PIPE SIZE	BASE NUMBERS	DIM	ENSIONS B	(mm)	BASE NUMBERS	A	В	<b>c</b> 5.4	NUMBERS 214B91	2.80	2.7	6.9
	3/8"	245K91	3.6	1.5	5.4	251K91	3.6 (91)	1.6 (41)	(137)	215B91	(71,1)	(69)	(175)
2	1/2"	246K91	(91)	(38)	(137)	252K91	3.8	1.9	6.2	216B91	3.12	3.0	7.4 (188)
4	1/2"	247K91	3.8	1.7	6.2	253K91 254K91	(97)	(48)	(157)	217B91	(79,2)	(76)	(100)
	3/4"	248K91	(97)	(43)	(157)	2541(51			_	_	-	-	-
8	1"	249K91	4.8	2.4	9.1 (231)		_	-	holts no	rovided with each	n valve a	ssembl	y. Bolts

\*Specify valve model number and base number when ordering. Valve to base mounting bolts provand seals included in the seals ind

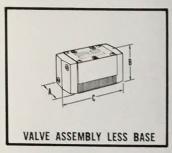


## **DOUBLE AIR OPERATED — 3 POSITION** SPRING CENTERED — ALL PORTS CLOSED



#### MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW

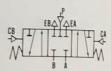


	was I was over I we wanted		MANUAL	DIN	*OVERAL		*FOR NO MANUA OVERRIDE ONLY	
NOM. Cv	PIPE SIZE W/BASE	NO MANUAL OVERRIDE	NON LOCKING	LOCKING	A	В	C	OTERRIDE UNLY
2	3/8"-1/2"	7057A3301	7057A3305	7057A3303	2.6 (66)	2.5 (64)	5.7 (145)	
4	1/2"-3/4"	7057A4301	7057A4305	7057A4303	3.0 (76)	2.5 (64)	6.6 (168)	
8	1"-11/4"	7057A6301	7057A6305	7057A6303	4.1 (104)	2.5 (64)	8.0 (206)	

OPERATION (When mounted on a base)

PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH PILOT SIGNALS EXHAUSTED: All ports closed. PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



## **DOUBLE AIR OPERATED — 3 POSITION** SPRING CENTERED — CYLINDER PORTS OPEN TO EXHAUST



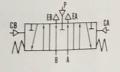
2	3/8"-1/2"	7057A3307	7057A3321	7057A3309	2.6 (66)	2.5 (64)	5.7 (145)
4	1/2"-3/4"	7057A4307	7057A4321	7057A4309	3.0 (76)	2.5 (64)	6.6 (168)
8	1"-11/4"	7057A6307	7057A6321	7057A6309	4.1 (104)	2.5 (64)	8.0 (206)

OPERATION (When mounted on a base)

PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH PILOT SIGNALS EXHAUSTED: Inlet P closed, outlet A exhausted via EA, outlet B exhausted via EB.

PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



#### STANDARD SPECIFICATIONS **OPERATOR**

PILOT SIGNAL: Filtered compressed air 15 psig (1 kp/cm²) Min., 150 psig (10 kp/cm²) Max.

SIGNAL PORT: Connection in base.

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

#### BODY

PRESSURE RANGE: Filtered compressed air 0-150 psig (0-10 kp/cm<sup>2</sup>).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

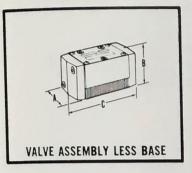
	BASE NUMBERS  SIDE PORTED BASE  DIMENSIONS (mm)			SIDE AND BOTTOM PORTED BASE				A					
NOMINAL	PIPE	BASE NUMBERS	DIM	ENSIONS B	(mm)	BASE NUMBERS		DRTED BA			NIFOLD B	ASE Ensions	(mm)
2	3/8" 1/2"	245K91 246K91	3.6 (91)	1.5 (38)	5.4 (137)	251K91	3.6	B 1.6	5.4	BASE NUMBERS	A	B 2.7	6.9
4	1/2" 3/4"	247K91 248K91	3.8 (97)	1.7 (43)	6.2 (157)	252K91 253K91	(91)	(41)	(137)	214B91 215B91	(71,1)	(69)	(175)
8	1"	249K91 250K91	4.8 (122)	2.4	9.1	254K91 —	(97)	(48)	(157)	216B91 217B91 — ——————————————————————————————————	3.12 (79,2)	3.0 (76)	(188)

## AIR OPERATED - SPRING RETURNED



#### MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW

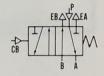


NOM.	PIPE SIZE W/BASE	NO MANUAL	DIM	OVERALI ENSIONS	
UV	W/ DASE	OVERRIDE	A	В	C
4	1/2"-3/4"	7156A4301	3.0 (76)	2.5 (64)	6.6 (168)
8	1"-11/4"	7156A6301	4.1 (104)	2.5 (64)	8.0 (206)

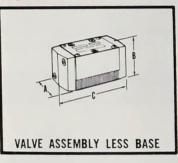
#### OPERATION (When mounted on a base)

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, outlet B exhausted via EB.

PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



# DOUBLE AIR OPERATED MOMENTARY WITH DETENT



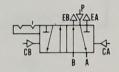
4	1/2"-3/4"	7156A4307	3.0 (76)	2.5 (64)	6.6 (168)
8	1"-11/4"	7156A6307	4.1 (104)	2.5 (64)	8.0 (206)

#### **OPERATION** (When mounted on a base)

MOMENTARY PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB.

MOMENTARY PILOT SIGNAL TO CB: Inlet P open to outlet B,

MOMENTARY PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



#### STANDARD SPECIFICATIONS

#### **OPERATOR**

PILOT SIGNAL: Filtered and lubricated compressed air 35 psig (2,5 kp/cm²) min., 150 psig (10 kp/cm²) max.

SIGNAL PORT: Connection in base.

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

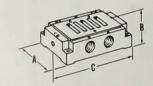
#### BODY

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).

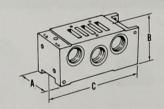
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.







	Circle Pr
1	A
1	6



#### SIDE PORTED BASE

SIDE AND BOTTOM PORTED BASE

\*MANIFOLD BASE

NOMINAL CV	PIPE	BASE NUMBERS	DIM A	ENSIONS B	(mm) C	BASE NUMBERS	DIM A	ENSIONS B	(mm) C	BASE NUMBERS	DIME	NSIONS B	(mm) C
4	1/2" 3/4"	247K91 248K91	3.8 (97)	1.7 (43)	6.2 (157)	253K91 254K91	3.8 (97)	1.9 (48)	6.2 (157)	216B91 217B91	3.12 (79,2)	3.0 (76)	7.4 (188)
8	1" 11/4"	249K91 250K91	4.8 (122)	2.4 (61)	9.1 (231)		_	_	-		-	1	-

<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.

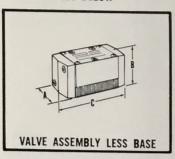


# DOUBLE AIR OPERATED — 3 POSITION SPRING CENTERED — ALL PORTS CLOSED



#### MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW

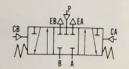


NOM.	PIPE SIZE	NO MANUAL	DIM	OVERALL DIMENSIONS (mm)				
Cv	W/BASE	OVERRIDE	A	В	C			
4	1/2"-3/4"	7157A4301	3.0 (76)	2.5 (64)	6.6 (168)			
8	1"-11/4"	7157A6301	4.1 (104)	2.5 (64)	8.0 (206)			

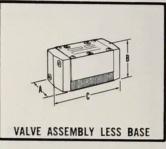
OPERATION (When mounted on a base)

PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH PILOT SIGNALS EXHAUSTED: All ports closed. PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



# DOUBLE AIR OPERATED — 3 POSITION SPRING CENTERED — CYLINDER PORTS OPEN TO EXHAUST



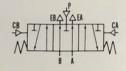
4	½"-¾" 7157A4307		3.0 (76)	2.5 (64)	6.6 (168)
8	1"-11/4"	7157A6307	4.1 (104)	2.5 (64)	8.0 (206)

OPERATION (When mounted on a base)

PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB.

BOTH PILOT SIGNALS EXHAUSTED: Inlet P closed, outlet A exhausted via EA, outlet B exhausted via EB.

PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



#### STANDARD SPECIFICATIONS

**OPERATOR** 

PILOT SIGNAL: Filtered and lubricated compressed air 35 psig (2,5 kp/cm²) min., 150 psig (10 kp/cm²) max.

SIGNAL PORT: Connection in base.

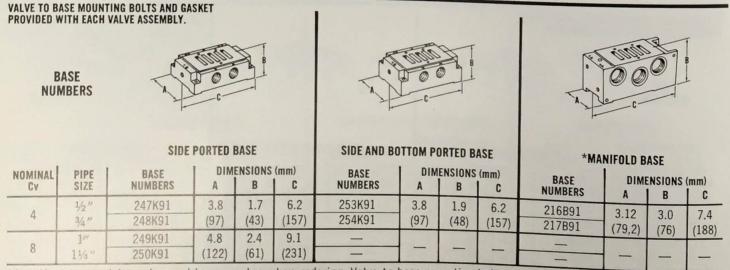
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

#### BODY

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40%F (400) - 175%F

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.



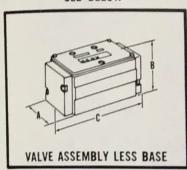
<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.

# AIR OPERATED INTERNAL PRESSURE RETURNED



#### MODEL NUMBERS — VALVE LESS BASE

VALVE BASE MUST BE ORDERED SEPARATELY SEE BELOW

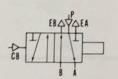


NOM.	PIPE SIZE W/BASE	NO MANUAL	OVERALL DIMENSIONS (mm)				
01	W/DASE	OVERRIDE	A	B   C			
2	3/8"-1/2"	7256A3301	2.7 (69)	2.7 (69)	5.5 (140)		
4	1/2"-3/4"	7256A4301	3.1 (79)	2.7 (69)	6.1 (155)		
10	1"-11/4"	7256A6301	4.1 (104)	3.2 (81)	7.9 (201)		

OPERATION (When mounted on a base)

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, outlet B exhausted via EB.

PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.



#### STANDARD SPECIFICATIONS

#### **OPERATOR**

PILOT SIGNAL: Fitered compressed air. Pilot signal should be equal to main valve pressure but never less than 15 psig (1 kp/cm²).

SIGNAL PORT: Connection in base.

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

#### BODY

PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 kp/cm²).

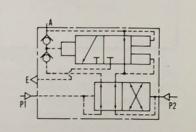
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) Min., 175°F (80°C) Max.

PROVIDED WITH EACH VALVE ASSEMBLY.  BASE NUMBERS									A	O O	0	В	
SIDE PORTED BASE			SIDE AND BO	TTOM PO	RTED BA	SE	*MANIFOLD BASE						
NOMINAL		BASE		ENSIONS	(mm) I C	BASE NUMBERS		ENSIONS	(mm)	BASE NUMBERS		ENSIONS B	(mm)
	SIZE	NUMBERS	A	В	U	NUMBERS	А		U		A	D	-
0	3/8"	245K91	3.6	1.5	5.4	251K91	3.6	1.6	5.4	214B91	2.80	2.7	6.9
2	1/2"	246K91	(91)	(38)	(137)	252K91	(91)	(41)	(137)	215B91	(71,1)	(69)	(175)
	1/2"	247K91	3.8	1.7	6.2	253K91	3.8	1.9	6.2	216B91	3.12	3.0	7.4
4	3/4"	248K91	(97)	(43)	(157)	254K91	(97)	(48)	(157)	217B91	(79,2)	(76)	(188)
10	1"	249K91	4.8	2.4	9.1					_			
10	11/4"	250K91	(122)	(61)	(231)	_							

<sup>\*</sup>Specify valve model number and base number when ordering. Valve to base mounting bolts provided with each valve assembly. Bolts and seals included with manifold for multiple station assembly.



PIPE	MODEL	OVERALL DIMENSIONS (mm)					
SIZE	NUMBERS	A	В	C			
1/4"	1868A2003	3.0 (76)	2.0 (51)	4.1 (104)			



#### STANDARD SPECIFICATIONS

ACTUATION: Two separate pressure signals from 3-way normally closed valves.

PRESSURE RANGE: Filtered and lubricated compressed air. Both signals should be equal but never less than 30 psig (2 kp/cm²) or more than 150 psig (10 kp/cm²).

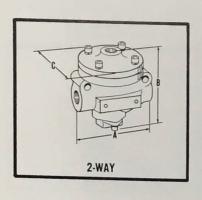
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

#### **OPERATION:**

PILOT SIGNALS EXHAUSTED: Outlet A open to exhaust. FIRST SIGNAL APPLIED TO EITHER P1 or P2: Outlet A remains open to exhaust.

SECOND SIGNAL APPLIED TO EITHER P1 or P2: Outlet open to second signal, exhaust closed.





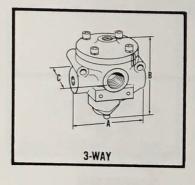
PIPE	NORMALLY	NUMBERS NORMALLY	OVERALL DIMENSIONS (mm)			
SIZE	CLOSED	OPEN	A	В	C	
1/4" 3/8" 1/2"	2751A2001 2751A3001 2751A4011	2752A2001 2752A3001 2752A4011	3.6 (91)	3.6 (91)	3.0 (76)	NORMALLY CLOSED
1/2" 3/4" 1"	2751A4001 2751A5001 2751A6011	2752A4001 2752A5001 2752A6011	4.6 (117)	4.2 (107)	3.0 (76)	<del></del>
1" 1½" 1½"	2751A6001 2751A7001 2751A8011	2752A6001 2752A7001 2752A8011	6.6 (168)	7.3 (185)	4.1 (104)	NORMALLY OPEN
1½" 2" ½"	2651A8001 2651A9001 2561A9011	2652A8001 2652A9001 2652A9011	8.5 (218)	8.8 (224)	5.1 (130)	

OPERATION: Normally Closed.

PILOT SIGNAL EXHAUSTED: Inlet P closed to outlet A.

PILOT SIGNAL PRESENT: Inlet P open to outlet A.

OPERATION: Normally Open.
PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A.
PILOT SIGNAL PRESENT: Inlet P closed to outlet A.



1/4" 3/8" 1/2"	2753A2001 2753A3001 2753A4011	2754A2001 2754A3001 2754A4011	3.6 (91)	3.8 (97)	3.1 (79)	NORMALLY CLOSED
<sup>1/2</sup> " <sup>3/4</sup> " 1"	2753A4001 2753A5001 2753A6011	2754A4001 2754A5001 2754A5011	4.6 (117)	4.6 (117)	3.6 (91)	
1" 1½" 1½"	2753A6001 2753A7001 2753A8011	2754A6001 2754A7001 2754A8011	6.6 (168)	7.3 (185)	4.8 (122)	NORMALLY OPEN
1½" 2" 2½"	2653A8001 2653A9001 2653A9011	2654A8001 2654A9001 2654A9011	8.6 (218)	9.3 (236)	6.3 (160)	

OPERATION: Normally Closed.

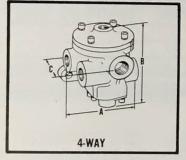
PILOT SIGNAL EXHAUSTED: Inlet P closed, outlet A exhausted via E.

PILOT SIGNAL PRESENT: Inlet P open to outlet A, exhaust closed.

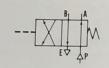
OPERATION: Normally Open.

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, exhaust closed.

PILOT SIGNAL PRESENT: Inlet P closed, outlet A exhausted via E.



1/4" 3/8" 1/2"	2756A2001 2756A3001 2756A4011	3.9 (99)	3.8 (97)	3.8 (97)
1/2" 3/4" 1"	2756A4001 2756A5001 2756A6011	4.4 (112)	5.6 (142)	5.2 (132)
1" 1½" 1½"	2756A6001 2756A7001 2756A8011	6.5 (165)	7.3 (185)	8.1 (206)



#### **OPERATION**

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, outlet B exhausted via E.

PILOT SIGNAL PRESENT: Inlet P open to outlet B, outlet A exhausted via E.

#### STANDARD SPECIFICATIONS

#### OPERATOR

PILOT SIGNAL: Filtered compressed air. Pilot signal should be equal to main valve pressure but never less than 15 psig (1 kp/cm²).

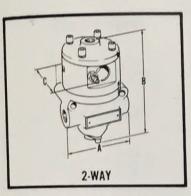
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

#### BODY

PRESSURE RANGE: Filtered compressed air 5-150 psig (0,3-10 kp/cm²). MEDIA TEMPERATURE:  $40^{\circ}F$  ( $4^{\circ}C$ ) min.,  $175^{\circ}F$  ( $80^{\circ}C$ ) max.

# AIR OPERATED - 2, 3, AND 4-WAY TIMED IN SEQUENCE TYPE

# HEADLINE SERIES POPPET CONSTRUCTION INLINE MOUNTED



PIPE SIZE	MODEL N NORMALLY CLOSED	NORMALLY	DIM	OVERALI		
JILL	CLUSED	OPEN	A	В	C	
1/4" 3/8" 1/2"	2751A2002 2751A3002 2751A4012	2752A2002 2752A3002 2752A4012	3.6 (91)	4.8 (122)	3.5 (89)	NORMALLY CLOSED
1/2" 3/4" 1"	2751A4002 2751A5002 2751A6012	2752A4002 2752A5002 2752A6012	4.6 (117)	5.4 (137)	3.5 (89)	NORMALLY OPEN
1" 1½" 1½"	2751A6002 2751A7002 2751A8012	2752A6002 2752A7002 2752A8012	6.6 (168)	8.5 (216)	4.1 (104)	- The state of the
						ΦP

OPERATION: Normally Closed.

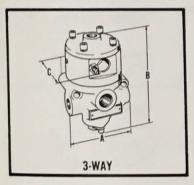
PILOT SIGNAL EXHAUSTED: Inlet P closed to outlet A. PILOT SIGNAL PRESENT: After pre-set delay inlet P opens to outlet A.

MAXIMUM ADJUSTABLE DELAY: 30 seconds.

OPERATION: Normally Open.

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A.
PILOT SIGNAL PRESENT: After pre-set delay inlet P closes
to outlet A.

MAXIMUM ADJUSTABLE DELAY: 30 seconds.



1/4" 3/8" 1/2"	2753A2002 2753A3002 2753A4012	2754A2002 2754A3002 2754A4012	3.6 (91)	5.0 (127)	3.5 (89)	NORMALLY CLOSED
1/2" 3/4" 1"	2753A4002 2753A5002 2753A6012	2754A4002 2754A5002 2754A6012	4.6 (117)	5.8 (147)	3.6 (91)	NORMALLY OPEN
1" 1¼" 1½"	2753A6002 2753A7002 2753A8012	2754A6002 2754A7002 2754A8012	6.6 (168)	8.5 (216)	4.8 (122)	
						E → Ap

OPERATION: Normally Closed.

PILOT SIGNAL EXHAUSTED: Inlet P closed, outlet A exhausted via E.

PILOT SIGNAL PRESENT: After pre-set delay inlet P opens to outlet A, exhaust closes.

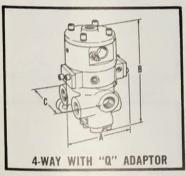
MAXIMUM ADJUSTABLE DELAY: 3 seconds.

OPERATION: Normally Open.

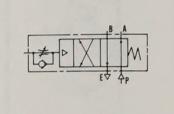
PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, exhaust closed.

PILOT SIGNAL PRESENT: After pre-set delay inlet P closes, outlet A opens to exhaust via E.

MAXIMUM ADJUSTABLE DELAY: 3 seconds.



1/4" 3/8" 1/2"	2786A2002 2786A3002 2786A4012	3.9 (99)	6.0 (152)	3.8 (97)
1/2" 3/4" 1"	2786A4002 2786A5002 2786A6012	4.4 (112)	7.8 (198)	5.2 (132)
1" 1½" 1½"	2786A6002 2786A7002 2786A8012	6.5 (165)	9.5 (242)	8.1 (206)



#### **OPERATION**

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, outlet

B exhausted via E.

PILOT SIGNAL PRESENT: After pre-set delay inlet P opens to outlet B, outlet A opens to exhaust via E.

MAXIMUM ADJUSTABLE DELAY: 60 seconds.

#### STANDARD SPECIFICATIONS

#### **OPERATOR**

PILOT SIGNAL: Filtered compressed air. Pilot signal should be equal to main valve pressure but never less than 30 psig (2 kp/cm²). The metering stem can be adjusted to Time-In the pilot signal.

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

#### TDF MODIFICATION

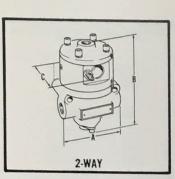
A 2-, 3- or 4-way timed-in sequence type valve with an internal pilot passage. Pressure applied to the inlet port causes the valve to operate after an adjustable time delay period. The valve reverses upon exhausting supply pressure. For details consult your Ross Representative or Ross Operating Valve Company.

#### BODY

PRESSURE RANGE: Filtered compressed air 5-150 psig (0,3-10 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.





PIPE SIZE	MODEL N NORMALLY CLOSED	UMBERS NORMALLY OPEN	DIM	OVERALI ENSIONS B		
1/4" 3/8" 1/2"	2751A2003 2751A3003 2751A4013	2752A2003 2752A3003 2752A4013	3.6 (91)	4.8 (122)	3.5 (89)	NORMALLY CLOSED
1/2" 3/4" 1"	2751A4003 2751A5003 2751A6013	2752A4003 2752A5003 2752A6013	4.6 (117)	5.4 (137)	3.5 (89)	NORMALLY OPEN
1" 1½" 1½"	2751A6003 2751A7003 2751A8013	2752A6003 2752A7003 2752A8013	6.6 (168)	8.5 (216)	4.1 (104)	- L
						Ŷ₽

OPERATION: Normally Closed.

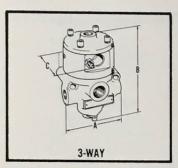
PILOT SIGNAL EXHAUSTED: After pre-set delay inlet P closes to outlet A.

PILOT SIGNAL PRESENT: Inlet P opens to outlet A. MAXIMUM ADJUSTABLE DELAY: 30 seconds.

OPERATION: Normally Open.

PILOT SIGNAL EXHAUSTED: After pre-set delay inlet P opens to outlet A.

PILOT SIGNAL PRESENT: Inlet P closes to outlet A. MAXIMUM ADJUSTABLE DELAY: 30 seconds.



1/4" 3/8" 1/2"	2753A2003 2753A3003 2753A4013	2754A2003 2754A3003 2754A4013	3.6 (91)	5.0 (127)	3.5 (89)	NORMALLY CLOSED
1/2" 3/4" 1"	2753A4003 2753A5003 2753A6013	2754A4003 2754A5003 2754A6013	4.6 (117)	5.8 (147)	3.6 (91)	ΕV Ap
1" 1¼" 1½"	2753A6003 2753A7003 2753A8013	2754A6003 2754A7003 2754A8013	6.6 (168)	8.5 (216)	4.8 (122)	NORMALLY OPEN

OPERATION: Normally Closed.

PILOT SIGNAL EXHAÚSTED: After pre-set delay inlet P closes, outlet A opens to exhaust via E.

PILOT SIGNAL PRESENT: Inlet P opens to outlet A, exhaust closed.

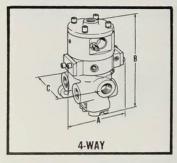
MAXIMUM ADJUSTABLE DELAY: 3 seconds.

OPERATION: Normally Open.

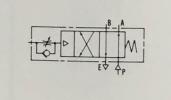
PILOT SIGNAL EXHAUSTED: After pre-set delay inlet P opens to outlet A, exhaust closes.

PILOT SIGNAL PRESENT: Inlet P closes, outlet A opens to exhaust via E.

MAXIMUM ADJUSTABLE DELAY: 3 seconds.



1/4" 3/8" 1/2"	2786A2003 2786A3003 2786A4013	3.9 (99)	6.0 (152)	3.8 (97)
1/2" 3/4" 1"	2786A4003 2786A5003 2786A6013	4.4 (112)	7.8 (198)	5.2 (132)
1" 1½" 1½"	2786A6003 2786A7003 2786A8013	6.5 (165)	9.5 (242)	8.1 (206)



#### **OPERATION**

PILOT SIGNAL EXHAUSTED: After pre-set delay inlet P opens to outlet A, outlet B opens to exhaust via E.

PILOT SIGNAL PRESENT: Inlet P opens to outlet B, outlet A opens to exhaust via E.

MAXIMUM ADJUSTABLE DELAY: 60 seconds.

# TIMED IN AND/OR TIMED OUT SEQUENCE TYPE

Delays the valve actuation after application of pilot signal and/or delays valve reversal after exhausting pilot signal. Available for 2-, 3- or 4-way valve function. For details consult your Ross Representative or Ross Operating Valve Company.

#### STANDARD SPECIFICATIONS

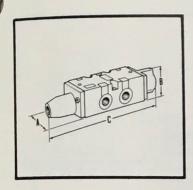
#### **OPERATO!**

PILOT SIGNAL: Filtered compressed air. Pilot signal should be equal to main valve pressure but never less than 30 psig (2 kp/cm²). The metering stem can be adjusted to Time-Out the pilot signal.

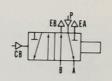
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

#### BODY

PRESSURE RANGE: Filtered compressed air 15-150 psig (1-10 kp/cm²)
MEDIA TEMPERATURE: 40°F (4°C) min., 170°F (80°C) max.



PIPE SIZE	ORIFICE DIA.	MODEL NUMBERS INTERNAL	OVERALL DIMENSIONS (mm)		(mm)
	5	PRESSURE RETURN	A	В	C
1/4"	.25	2456A2011	2.0 (51)	1.3 (33)	5.7 (145)
1/4"	.38	2456A2001	2.3	1.6	8.0
3/8″	.38	2456A3011	(58)	(41)	(203)

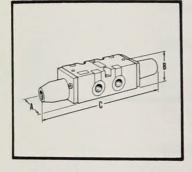


#### **OPERATION**

PILOT SIGNAL EXHAUSTED: Inlet P open to outlet A, outlet B exhausted via EB.

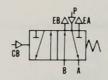
PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.

BASE AND MANIFOLD MOUNTED MODELS AVAILABLE.



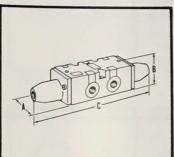
#### SPRING RETURN

1/4"	.25	2456A2017	2.0 (51)	1.3 (33)	6.3 (160)
1/4"	.38	2456A2007	2.3	1.6 (41)	8.0 (203)
3/8″	.38	2456A3017	(58)		

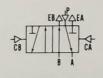


## **DOUBLE AIR OPERATED - 4-WAY**

MOMENTARY



PIPE	ORIFICE	MODEL NUMBERS	DIMENSIONS (mi		
SIZE	DIA.	WITHOUT DETENT	A	В	C
1/4″	.25	2456A2012	2.0 (51)	1.3 (33)	6.2 (157)
1/4"	.38	2456A2002	2.3 (58)	1.6	8.6
3/8″	.38	2456A3012	(58)	(41)	(218)

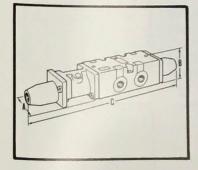


#### **OPERATION**

MOMENTARY PILOT SIGNAL TO CA: Inlet P open to outlet A, outlet B exhausted via EB.

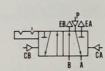
MOMENTARY PILOT SIGNAL TO CB: Inlet P open to outlet B, outlet A exhausted via EA.

BASE AND	MANIFOLD
MOUNTED	MODELS
AVAILABLI	E.



#### WITH DETENT

1/4"	.25	2456A2013	2.0 (51)	1.3 (33)	7.9 (200)
1/4"	.38	2456A2003	2.3	1.6	10.8
3/8"	.38	2456A3013	(58)	(41)	(274)



#### STANDARD SPECIFICATIONS

#### **OPERATOR**

PILOT SIGNAL: Filtered and lubricated compressed air. Pilot signal should be equal to main valve pressure but never less than 30 psig (2 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

#### BODY

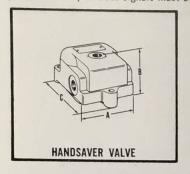
PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).\*

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

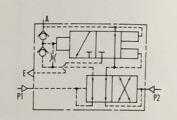
\*30-150 psig (2-10 kp/cm²) for internal pressure returned models.



The Handsaver Valve or Handsaver Pilot is designed to receive two separate pressure signals — one signal from each of the two threeway normally closed valves. To produce an output, both signals must be applied within approximately one second or less of each other. Should the time interval for applying both signals be exceeded, the Handsaver shifts and does not produce an output. Both signals must be exhausted to reset valve.



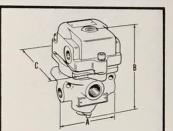
PIPE	MODEL	OVERALL DIMENSIONS (mm)			
SIZE	NUMBERS	A	В	C	
1/4"	1868A2002	3.0 (76)	2.1 (54)	4.1 (104)	



#### OPERATION:

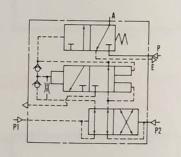
PILOT SIGNALS TO P1 and P2 EXHAUSTED: Outlet A exhausted. PILOT SIGNALS TO P1 and P2 APPLIED WITHIN PRESCRIBED TIME INTERVAL:

Outlet A open, exhaust closed.



3-WAY HANDSAVER PILOT

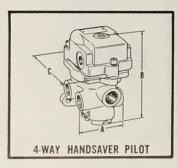
1/4" 3/8" 1/2"	2753A2006 2753A3006 2753A4016	3.6 (91)	5.9 (150)	4.1 104)
1/2" 3/4" 1"	2753A4006 2753A5006 2753A6016	4.6 (117)	6.7 (170)	4.1 (104)
1" 1½" 1½"	2753A6006 2753A7006 2753A8016	6.6 (168)	9.4 (239)	4.8 (122)



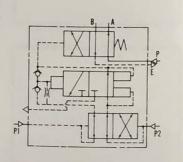
#### OPERATION:

PILOT SIGNALS TO P1 and P2 EXHAUSTED: Inlet P closed, outlet A exhausted via E.

PILOT SIGNALS TO P1 and P2 APPLIED WITHIN PRESCRIBED TIME INTERVAL: Inlet P open to outlet A, exhaust closed.



1/4" 3/8" 1/2"	2756A2006 2756A3006 2756A4016	3.9 (99)	5.9 (150)	4.1 (104)
<sup>1</sup> / <sub>2</sub> " <sup>3</sup> / <sub>4</sub> " 1"	2756A4006 2756A5006 2756A6016	4.4 (112)	7.7 (196)	5.2 (132)
1" 1¼" 1½"	2756A6006 2756A7006 2756A8016	6.5 (165)	9.4 (239)	8.1 (206)



#### OPERATION:

PILOT SIGNALS TO P1 and P2 EXHAUSTED: Inlet P open to outlet A, outlet B exhausted via E.

PILOT SIGNALS TO P1 and P2 APPLIED WITHIN PRESCRIBED TIME INTERVAL: Inlet P open to outlet B, outlet A exhausted via E.

#### STANDARD SPECIFICATIONS

PILOT SIGNALS: Filtered and lubricated compressed air 30-150 psig (2-10 kp/cm²). Both pilot signals should be equal but never less than 30 psig (2 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F

BODY: With Handsaver Pilot
PRESSURE RANGE: Filtered and compressed air.
5-150 psig (0,3-10 kp/cm²). Pilot signals should be equal to main valve pressure but never less than 30 psig (2 kp/cm²).
AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

# MANUALLY OPERATED - 2 AND 3-WAY



PIPE SIZE	MODEL N	DIME	*OVERA Ension: B	LL S (mm)   C	
1/.//	GREEN BUTTON 1 1221D2001	RED BUTTON 1221D2003	2.6	2.4	3.0
1/4"	GREEN BUTTON 1223D2001	RED BUTTON 1223D2003	(66)	(61)	(76)

#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm<sup>2</sup>).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

OPERATION: 2-Way.

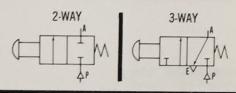
BUTTON RELEASED: Inlet P closed to outlet A.

BUTTON PUSHED: Inlet P open to outlet A.

OPERATION: 3-Way.

BUTTON RELEASED: Inlet P closed, outlet A open to exhaust.

BUTTON PUSHED: Inlet P open to outlet A, exhaust closed.





#### **GUARD NUMBER 279B30 FOR MODELS LISTED ABOVE**

For added protection, ring type guards are available for Palm Button Series. When ordering, specify Guard Number.

#### **GUARD NUMBER 278B30 FOR MODELS LISTED BELOW**



PALM BUTTON SERIES

1	GREEN BUTTON	RED BUTTON	1		
1/8"	1223A1005	1223A1006	2.3	1.6	2.8
1/4"	1223A2005	1223A2006	(58)	(41)	(71)

#### STANDARD SPECIFICATIONS

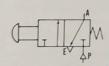
PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm<sup>2</sup>)

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

OPERATION:	3-Way.
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BUTTON RELEASED: Inlet P closed, outlet A open to exhaust.

BUTTON PUSHED: Inlet P open to outlet A, exhaust closed.





HAND SERIES

1	LEFT HAND	RIGHT HAND	1		
1/8"	1223A1007	1223A1008	2.8	2.2	5.3
1/4"	1223A2007	1223A2008	(71)	(56)	(135)

#### STANDARD SPECIFICATIONS

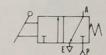
PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm<sup>2</sup>).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

OP	ER	AT	ION:	3-V	Vav.

LEVER RELEASED: Inlet P closed, outlet

A open to exhaust. LEVER PUSHED: Inlet P open to outlet A, exhaust closed.





1	PALM	BUTTON	1		
1/4"	2-WAY	3-WAY	1.8	3.3	2.8
	PCB21	PCB61	(46)	(84)	(71)
74	BALL HA	ND TOGGLE	1.8	5.9	2.8
	PCB27	PCB67	(46)	(150)	(71)

#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max. Non-piped exhaust, bottom or side mounting flange.

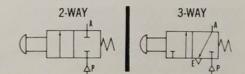
U	۲	Ł	KA	ı	IUN	: 4	- V	va	у.

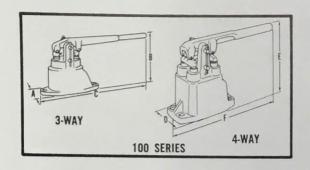
RELEASED: Inlet P closed to outlet A. PUSHED: Inlet P open to outlet A.

OPERATION: 3-Way.

RELEASED: Inlet P closed, outlet A open to exhaust.

PUSHED: Inlet P open to outlet A, exhaust closed.





	MODELA	UMBERS	OVERALL DIMENSIONS (mm)						
SIZE	3-WAY	4-WAY	A	В	C	D	E	F	
3/8″	100M1	101M1	1.4 (36)	6.8 (173)	8.1 (206)	2.1 (53)	6.8 (173)	8.0 (203)	
1/2"	102M1	103M1	1.7 (43)	8.9 (226)	11.2 (284)	2.8 (71)	8.9 (226)	11.0 (279)	
3/4"	104M1	105M1	1.9 (48)	9.7 (246)	12.5 (318)	3.3 (84)	10.0 (254)	12.5 (318)	
1"	106M1	107M1	2.3 (58)	13.8 (351)	18.6 (472)	4.1 (104)	13.5 (343)	18.6 (472)	
11/4"	108M1	109M1	2.5 (64)	13.7 (348)	18.8 (478)	4.8 (122)	14.1 (358)	18.8 (478)	

OPERATION: 3-Way.

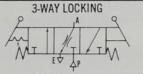
LEVER UP: Inlet P open to outlet A, exhaust closed. LEVER IN CENTER POSITION: Inlet P closed, outlet A metered to exhaust via E.

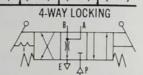
LEVER DOWN: Inlet P closed, outlet A exhausted via E.

OPERATION: 4-Way.

LEVER UP: Inlet P open to outlet A, outlet B exhausted via E. LEVER IN CENTER POSITION: Inlet P closed, outlets A and B metered to exhaust via E.

LEVER DOWN: Inlet P open to outlet B, outlet A exhausted via E.

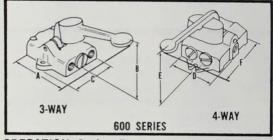




#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max. Three position locking, bottom ported.



OPERATION: Spring Return - 3-Way.

LEVER UP: Inlet P closed, outlet A exhausted via E. LEVER DOWN: Inlet P open to outlet A, exhaust closed.

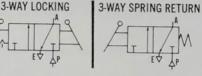
OPERATION: Locking Type - 3-Way.

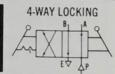
LEVER UP: Inlet P open to outlet A, exhaust closed. LEVER DOWN: Inlet P closed, outlet A exhausted via E.

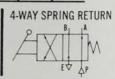
OPERATION: 4-Way.

LEVER UP: Inlet P open to outlet B, outlet A exhausted via E. LEVER DOWN: Inlet P open to outlet A, outlet B exhausted via E.

	3-WAT	4-WAT	A	l R	C	1 D	I E	l F
1/4"	LOCI	KING						
	602M2X02	603M2X02	7.3 (185)	3.2	3.4	3.3	3.9	7.8
	SPRING 602M2X04	RETURN 603M2X04		(81)	(86)	(84)	(99)	(198)







#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm<sup>2</sup>).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

3-WAY	4-WAY
	600 SERIES

OPERATION: Single Treadle - 3-Way. TREADLE UP: Inlet P closed, outlet A exhausted via E.

TREADLE DOWN: Inlet P open to outlet A, exhaust closed.

OPERATION: Double Treadle - 3-Way. TREADLE DOWN OVER PORT P: Inlet P closed, outlet A exhausted via E TREADLE DOWN OVER PORT E: Inlet P open to outlet A, exhaust closed.

	3-WAY	4-WAY	1					
1/4"	600M2X12	DLE LOCKING 601M2X12	6.0 (152)	1.9	3.4	3.3	2.5 (64)	6.5 (165)
/4	SINGLE TREADS 600M2X04	E SPRING RET. 601M2X04	6.4 (163)	2.6 (66)	(86)	(84)	2.9	7.2 (183)

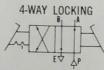
3-WAY LOCKING

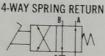
OPERATION: Single Treadle - 4-Way. TREADLE UP: Inlet P open to outlet B, outlet A exhausted via E. TREADLE DOWN: Inlet P open to outlet A,

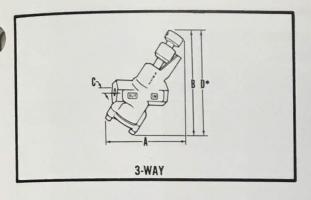
outlet B exhausted via E.

OPERATION: Double Treadle - 4-Way. TREADLE DOWN OVER PORT B: Inlet P open to outlet B, outlet A exhausted via E. TREADLE DOWN OVER PORT A: Inlet P open to outlet A, outlet B exhausted via E.





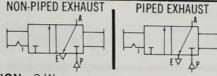




#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²). AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

PIPE 1		NUMBERS	1	OVE	RALL	
SIZE	NON-PIPED Exhaust	*PIPED EXHAUST	A	DIMENSI B		)   D*
3/8"	1924A3001	1924A3002	5.4	7.5	1.9	7.5
1/2"	1924A4001	1924A4002	(137)	(191)	(48)	(191)
3/4"	1924A5001	1924A5002	6.9	9.5	2.1	10.1
1"	1924A6001	1924A6002	(175)	(241)	(54)	(257)



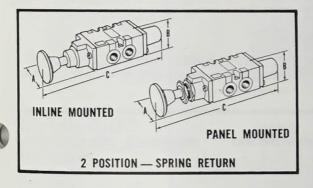
OPERATION: 3-Way.

KNOB PULLED: Inlet P open to outlet A, exhaust closed.

KNOB PUSHED: Inlet P closed, outlet A open to exhaust.

#### MANUALLY OPERATED — 4-WAY

COLT SERIES
RESILIENT SEAL
SPOOL CONSTRUCTION

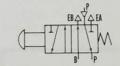


PIPE	ORIFICE	DIM	OVERAL ENSIONS			
SIZE	DIA.	MOUNTED	MOUNTED	A	В	C
1/4"	.25	2426A2011	2426A2012	2.0 (51)	1.3 (33)	7.8 (198)

#### **OPERATION**

BUTTON RELEASED: Inlet P open to outlet A, outlet B exhausted via EB.

BUTTON PUSHED: Inlet P open to outlet B, outlet A exhausted via EA.



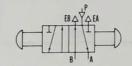
INLINE MOUNTED	PANEL MOUNTED
2 POSITION WITHOUT	DETENT

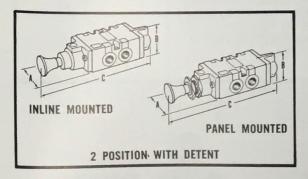
1/4"	.25	2426A2015	2426A2016	2.0 (51)	1.3 (33)	6.9 (175)
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#### **OPERATION**

KNOB PULLED: Inlet P open to outlet A, outlet B exhausted via EB.

KNOB PUSHED: Inlet P open to outlet B, outlet A exhausted via EA.



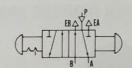


1/4"	.25	2426A2013	2426A2014	2.0 (51)	1.3 (33)	6.9 (175
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#### **OPERATION**

KNOB PULLED: Inlet P open to outlet A, outlet B exhausted via EB.

KNOB PUSHED: Inlet P open to outlet B, outlet A exhausted via EA.

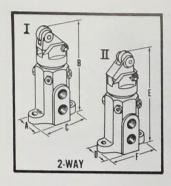


#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

## CAM OPERATED - 2, 3, AND 4-WAY

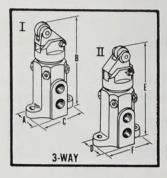


PIPE	T MODEL	NUMBERS II OVERRIDING	1	OVER	ALL DIM	IENSION	IS (mm)	
SIZE	ROLLER CAM	ROLLER CAM	A	В	C	D	E	F
	BOTTON PCB15	FLANGE PCB15VMI	1.6 (41)	4.4 (112)	2.6 (66)	1.6 (41)	4.5 (113)	2.6 (66)
1/4"	PCB25	FLANGE PCB25VMI	1.7 (43)	4.4 (112)	2.8 (71)	1.7 (43)	4.5 (113)	2.8 (71)

OVERRIDING ROLLER CAM

OPERATION: 2-Way.

ROLLER CAM RELEASED: Inlet P closed to outlet A. ROLLER CAM PUSHED: Inlet P open to outlet A.



1/ //	BOTTON PCB35	M FLANGE PCB35VMI	1.6 (41)	4.4 (112)	2.6 (66)	1.6 (41)	4.5 (113)	2.6 (66)
1/4"	PCB65	FLANGE PCB65VMI	1.7 (43)	4.4 (112)	2.8 (71)	1.7 (43)	4.5 (113)	2.8 (71)

OPERATION: 3-Way.

ROLLER CAM RELEASED: Inlet P closed, outlet A exhausted. ROLLER CAM PUSHED: Inlet P open to outlet A, exhaust

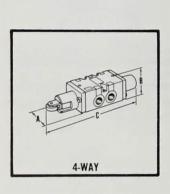


ROLLER CAM

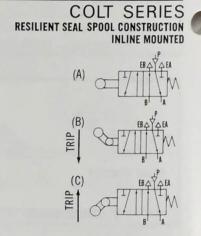
#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²).

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max. Non-piped exhaust, bottom or side mounting flange.



PIPE SIZE	ORIFICE DIA.	MODEL NUMBERS	DIM	OVER/ ENSION B	
(A) ROI	LER CAM				
1/4"	.25	2436A2011			
DIRECT	ERRIDING ROLL ION OF CAM I TO CYLINDER				
			2.0 (51)	1 2	100
1/4"	.25	2436A2013		1.3 (33)	6.9 (175)
(C) DIF	.25 RECTION OF CA				6.9 (175)



#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²) .

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

OPERATION: 4-Way.

ROLLER CAM RELEASED: Inlet P open to outlet A, outlet B exhausted via EB.

ROLLER CAM PUSHED: Inlet P open to outlet B, outlet A exhausted via EA.

#### OTHER MODELS AVAILABLE IN THE HEADLINE SERIES



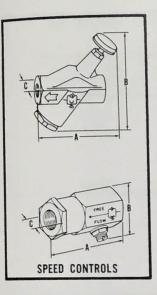
SINGLE SOLENOID PILOT OPERATED TIMED IN AND/OR TIMED OUT SEQUENCE TYPE 2-WAY, 3-WAY, 4-WAY PIPE SIZES 1/4" THRU 11/2"



EXPLOSION PROOF SINGLE SOLENOID PILOT OPERATED 2-WAY, 3-WAY, 4-WAY PIPE SIZES 1/4" THRU 11/2"



SINGLE SOLENOID PILOT OPERATED 2-WAY, 3-WAY PIPE SIZE 1½", 2", 2½"

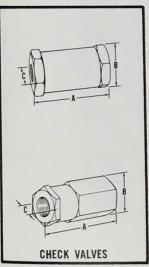


PIPE SIZE	MODEL NUMBERS	DIM	OVERALL ENSIONS B	
1/4" 3/8"	515M1 516H1	2.7 (69)	4.4 (112)	1.3 (33)
1/2" 3/4"	517M1 518M1	3.8 (97)	5.6 (142)	1.8 (46)
1" 11/4"	519M3 520M3	5.0 (127)	7.0 (178)	2.3 (58)
1½"	521M1 522M1	6.8 (173)	9.3 (236)	3.1 (79)
1/8"	1968C1004	2.4	1.6	1.2
1/4"	1968C2004	(61)	(41)	(30)



OPERATION: Free flow to work. Adjustable controlled flow from work. TO INCREASE CONTROLLED FLOW: Turn adjustment screw in. TO DECREASE CONTROLLED FLOW: Turn adjustment screw out.

OPERATION: Free flow to work. Adjustable controlled flow from work. TO INCREASE CONTROLLED FLOW: Turn adjustment screw out. TO DECREASE CONTROLLED FLOW: Turn adjustment screw in.



1/4"	1968B2001	2.8		
3/8"	1968B3001	(71)	1.6	1.4
1/2"	1968B4001	3.5 (89)	(41)	(36)

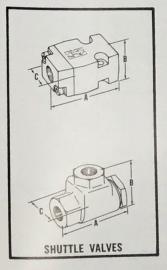


#### **OPERATION:**

Free flow in one direction. Closed to flow in reverse direction.



1/8"	1968A1005	2.5	1.0	1.2
1/4"	1968A2005	(64)	(25)	(30)



1/8"	1968A1006	2.1	1.1	1.6
1/4"	1968A2006	(53)	(28)	(41)

1/4"	1968A2003	2.4	1.8	1.2
3/8"	1968A3003	(61)	(46)	(30)



#### OPERATION:

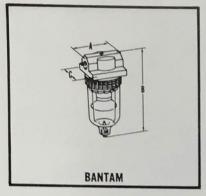
PRESSURE AT INLET P1, INLET P2 OPEN TO EXHAUST: Inlet P1 open to outlet A. PRESSURE AT INLET P2, INLET P1 OPEN TO EXHAUST: Inlet P2 open to outlet A.

#### STANDARD SPECIFICATIONS

PRESSURE RANGE: Filtered and lubricated compressed air 5-150 psig (0,3-10 kp/cm²)\*.

AMBIENT/MEDIA TEMPERATURE: 40°F (4°C) min., 175°F (80°C) max.

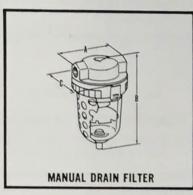
\*15-150 psig (1-10 kp/cm²) for Shuttle Valves.



PIPE	MODEL NUMBER		OVERA	LL DIMENS	IONS (mm
SIZE	PLASTIC BOWL	METAL BOWL	A	В	C
1/4"	5011A2010	5012A2010	1.5 (38)	3.8 (97)	1.6 (41)

Not available with metal bowl guard.







PIPE SIZE	METAL GUARD METAL ON PLASTIC BOWL BOWL		OVERALL DIMENSIONS A B		
1/4" Min.	5011A2007	_	2.7 (69)	4.5 (114)	2.9 (74)
1/4" 3/8" 1/2"	5011A2008 5011A3008 5011A4008	5012A2005 5012A3005 5012A4005	3.6 (91)	6.9 (175)	3.8 (97)
3/4" 1"	5011A5008 5011A6008	5012A5005 5012A6005	4.6 (117)	9.9 (251)	4.6 (117)
11/4"	5011A7008 5011A8008	5012A7005 5012A8005	7.9 (201)	18.3 (465)	8.0 (203)
2"	5011A9008	5012A9005	8.0 (203)	18.3 (465)	8.0 (203)





PIPE SIZE	METAL GUARD	METAL	OVERALL DIMENSIONS (mm)		
	ON PLASTIC BOWL	BOWL	A	B	C
1/4"	5021A2008	5022A2005			
3/8"	5021A3008	5022A3005	3.6		3.8 (97)
1/2"	5021A4008	5022A4005	(91)		
3/4"	5021A5008	5022A5005	4.6 (117)	0.0	
1"	5021A6008	5022A6005		9.9 (251)	4.6 (117)
1/4"	5021A7008	5022A7005	5022A7005 7.9 5022A8005 (201)		
11/2"	5021A8008			18.3 (465)	8.0 (203)
2"	5021A9008	5022A9005	8.0 (203)	18.3 (465)	8.0 (203)

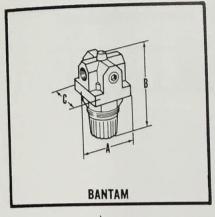
#### OPERATION:

Air entering the filter passes through a baffle which whips it into a centrifugal motion. Liquid and contaminants are thrown outward and fall into the bowl. The partially cleaned air then passes through a highly efficient felt filter element which removes particles larger than 5 microns. Contaminants collect in the quiet zone of the bowl and cannot be picked out by the air stream.

#### FLOW MEDIA:

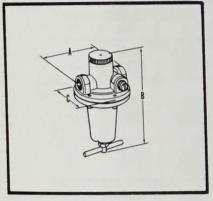
AMBIENT/MEDIA TEMPERATURE: Plastic Bowl — 130°F (54°C) Maximum. Metal Bowl – 200°F (93°C) Maximum. PRESSURE RANGE (MAXIMUM):

PLASTIC BOWL METAL BOWL 150 psig (10 kp/cm²) 150 psig Bantam 250 psig (17,6 kp/cm²) Manual Drain 250 psig (10 kp/cm<sup>2</sup>) (17,6 kp/cm²) 20 to 175 psig Automatic Drain 20 to 150 psig (1,4 to 10 kp/cm²) (1,4 to 12 kp/cm²)



PIPE MODEL NUM			OVERAL	L DIMENSIO	NS (mm)
SIZE	5-125 PSIG	2-50 PSIG	A	В	C
1/4"	5211A2005	5212A2005	1.5 (38)	2.9 (74)	1.5 (38)







PIPE SIZE	MODEL NUMBERS	OVERAL A	L DIMENSIO	NS (mm)
1/4" Min.	5211A2006	2.0 (51)	5.0 (127)	2.0 (51)
1/4" 3/8"	5211A2007 5211A3007	2.8 (71)	6.1 (155)	2.0 (51)
1/2"	5211A4007	3.2 (81)	7.0 (178)	3.6 (91)
3/4" 1"	5211A5007 5211A6007	4.4 (112)	10.6 (269)	4.7 (119)
1½" 1½"	5211A7007 5211A8007	5.0 (127)	10.8 (274)	4.9 (124)
2"	5211A9007	7.2 (183)	8.8 (224)	6.7 (170)

#### OPERATION:

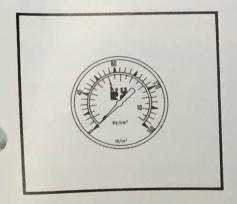
Automatically maintains outlet pressure at set level. A drop in downstream pressure causes the balanced poppet valve element to open and provide additional pressure. Valve poppet closes when pre-set pressure level is reached. Should the downstream pressure exceed the set pressure a bleed passage opens to reduce the over pressure condition.

#### **FLOW MEDIA:**

AMBIENT/MEDIA TEMPERATURE: 180°F (82°C) Maximum. REGULATED PRESSURE RANGE: 0 to 125 psig (0-8,8 kp/cm²). Bantam — 5 to 125 psig (0,3-8,8 kp/cm²).

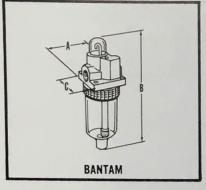
INLET PRESSURE: 400 psig (28 kp/cm²) Maximum. The maximum inlet pressure for the ½" Bantam and miniature models is 300 psig (21 kp/cm²).





PIPE SIZE	MODEL NUMBERS	PRESSUR	E RANGE kp/cm²	CASE DIAMETER (mm)
1/8"	5400A1001	0-160	0-11,3	1.7 (43)
	5400A2001	0-60	0-4,2	0.0
1/4"	5400A2002	0-160	0-11,3	2.2 (56)
	5400A2003	0-300	0-21	(30)

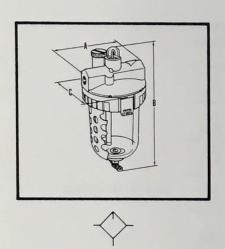
Center back mounting. Male pipe connection.



PIPE	MODEL NUMBERS		OVERAL	LL DIMENSIC	NS (mm
SIZE	PLASTIC BOWL	METAL BOWL	A	В	C
1/4"	5111A2010	5112A2010	1.5 (38)	4.5 (114)	1.5 (38)

Not available with metal bowl guard.





PIPE SIZE	METAL GUARD On Plastic Bowl			LL DIMENSI B	ONS (mm)
1/4" Min.	5111A2007	5112A2004	2.6 (66)	5.6 (142)	2.8 (71)
1/4"	5111A2008	5112A2005			
3/8"	5111A3008	5112A3005	3.6	8.0 (203)	3.8 (97)
1/2"	5111A4008	5112A4005	(91)		
3/4"	5111A5008	5112A5005	4.6	10.9 (277)	4.7 (119)
1"	5111A6008	5112A6005	(117)		
11/4"	5111A7008	5112A7005	5.5		
11/2"	5111A8008	5112A8005	(140)	12.2 (310)	4.7 (119)
2"	5111A9008	5112A9005	5.5 (140)	12.8 (325)	5.0 (127)

‡With sight gauge

#### OPERATION:

Automatically provides fine oil particles for lubricating pneumatic components. A flexible flow guide directs a portion of the incoming air through a venturi jet where the high velocity air atomizes the oil drops. The balance of the incoming air passes around the flexible flow guide and breaks up the fine oil particles still further and carries them a long distance downstream. A small passage directs inlet air to the bowl and forces lubrication through an adjustable needle valve into the venturi jet.

#### FLOW MEDIA:

AMBIENT/MEDIA TEMPERATURE: Plastic Bowl — 130°F (54°C) Maximum. Metal Bowl — 200°F (93°C) Maximum. PRESSURE RANGE (MAXIMUM):

> PLASTIC BOWL 150 psig (10 kp/cm²)

METAL BOWL 250 psig (17,6 kp/cm²)

SEE CAUTION - BELOW.

#### A WORD OF CAUTION:

In locations where fire-retardant lubrication is used or where other materials harmful to polycarbonate plastic are present, a metal bowl should be used. Ross plastic bowl units are equipped with a metal guard which help retain bowl fragments in case of plastic bowl failure.

Care should be used when selecting filters and lubricators with polycarbonate plastic bowls. Certain ambient conditions, compounds, synthetics, solvents, alkalies, etc., can harm the polycarbonate plastic.

For assistance check with your Ross Representative or Ross Operating Valve Company

General Electric or Mobay Chemical (Manufacturers of Polycarbonate)

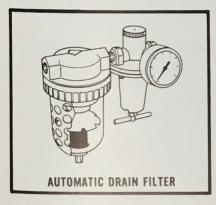


PIPE	MODEL NUMBER 5400A1001 GAUGE INCLUDED		
SIZE	PLASTIC BOWL	METAL BOWL	
1/4"	5321A2001	5322A2001	

Not available with metal bowl guard.



		CONSISTS OF		
PIPE SIZE	MODEL NUMBERS	FILTER	REGULATOR WITH GAUGE 5400A2002	
	METAL GUARI	ON PLASTIC BOWL		
1/4" MIN.	5321A2005	5011A2007	5211A2006	
1/4"	5321A2006	5011A2008	5211A2007	
3/8″	5321A3006	5011A3008	5211A3007	
1/2"	5321A4006	5011A4008	5211A4007	
3/4"	5321A5006	5011A5008	5211A5007	
		METAL BOWL		
1/4"	5322A2003	5012A2005	5211A2007	
3/8″	5322A3003	5012A3005	5211A3007	
1/2"	5322A4003	5012A4005	5211A4007	
3/4 "	5322A5003	5012A5005	5211A5007	



FL	n	W	M	FI	ni	A.
	v	44	IAI	E 1	ш.	IA:

AMBIENT/MEDIA TEMPERATURE: Plastic Bowl — 130°F (54°C) Maximum. Metal Bowl — 180°F (82°C) Maximum.

PIPE SIZE	MODEL NUMBERS	CONSIS FILTER	TS OF REGULATOR WITH GAUGE
SIZE	NUMBERS	FILIER	5400A2002
	METAL GUAR	D ON PLASTIC BOWL	
1/4"	5321A2007	5021A2008	5211A2007
3/8″	5321A3007	5021A3008	5211A3007
1/2"	5321A4007	5021A4008	5211A4007
3/4"	5321A5007	5021A5008	5211A5007
		METAL BOWL	_
1/4"	5322A2004	5022A2005	5211A2007
3/8″	5322A3004	5022A3005	5211A3007
1/2"	5322A4004	5022A4005	5211A4007
3/4 ′′	5322 <b>A</b> 5004	5022A5005	5211A5007

REGULATED PRESSURE RANGE: 0 to 125 psig (0-8,8 kp/cm²). Bantam -5 to 125 psig (0,3-8,8 kp/cm²).

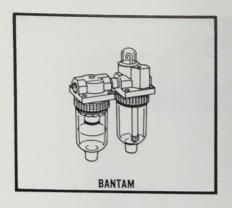
#### INLET PRESSURE (MINIMUM AND MAXIMUM):

| PLASTIC BOWL | METAL BOWL | 150 psig | 250 psig | (10 kp/cm²) | (17,6 kp/cm²) | (17,6 kp/cm²) | (10 kp/cm²) | (10 kp/cm²) | (10 kp/cm²) | (17,6 kp/cm²) | (10 kp/cm²) |

 $(1,4 \text{ to } 10 \text{ kp/cm}^2)$   $(1,4 \text{ to } 12 \text{ kp/cm}^2)$ 

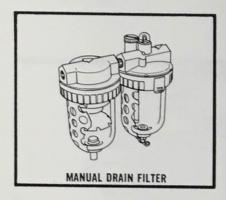


## FILTER - LUBRICATOR COMBINATION

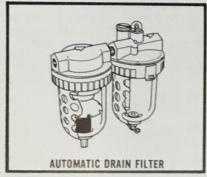


PIPE	MODEL	CONSI	STS OF
SIZE	NUMBERS	FILTER	LUBRICATOR
		PLASTIC BOWL	
1/4"	5311A2010	5011A2010	5111A2010
		METAL BOWL	
1/4"	5312A2010	5012A3010	5112A2010

Not available with metal bowl guard.



PIPE SIZE	MODEL NUMBERS	CONSI FILTER	STS OF LUBRICATOR
	METAL	GUARD ON PLASTI	C BOWL
1/4" MIN.	5311A2005	5011A2007	5111A2007
1/4"	5311A2006	5011A2008	5111A2008
3/8"	5311A3006	5011A3008	5111A3008
1/2"	5311A4006	5011A4008	5111A4008
3/4"	5311A5006	5011A5008	5111A5008
		METAL BOWL	W/SIGHT GAUGE
1/4"	5312A2003	5012A2005	5112A2005
3/8"	5312A3003	5012A3005	5112A3005
1/2"	5312A4003	5012A4005	5112A4005
3/4"	5312A5003	5012A5005	5112A5005



#### FLOW MEDIA:

AMBIENT/MEDIA TEMPERATURE: Plastic Bowl - 130°F (54°C) Maximum. Metal Bowl - 200°F (93°C) Maximum. PRESSURE RANGE (MAXIMUM):

Bantam Manual Drain Automatic Drain PLASTIC BOWL 150 psig (10 kp/cm²) 150 psig (10 kp/cm<sup>2</sup>)

CONSISTS OF SIZE NUMBERS FILTER LUBRICATOR METAL GUARD ON PLASTIC BOWL 1/4" 5311A2007 5021A2008 5111A2008 3/8" 5311A3007 5021A3008 5111A3008 1/2" 5311A4007 5021A4008 5111A4008 3/4" 5311A5007 5021A5008 5111A5008 METAL BOWL W/SIGHT GAUGE 1/4" 5312A2004 5022A2005 5112A2005 3/8" 5312A3004 5022A3005 5112A3005 1/2" 5312A4004 5022A4005 5112A4005 3/4" 5312A5004 5022A5005 5112A5005

MODEL

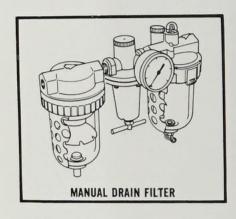
METAL BOWL 250 psig (17,6 kp/cm<sup>2</sup>) 250 psig (17,6 kp/cm²) 20 to 150 psig 20 to 175 psig (1,4 to 10 kp/cm²) (1,4 to 12 kp/cm²)

PIPE



PIPE	MODEL	CONSISTS	S OF
IZE	NUMBERS	FILTER-REGULATOR WITH GAUGE	LUBRICATOR
		PLASTIC BOWL	
1/4"	5331A2001	5321A2001	5111A2003
		METAL BOWL	
1/4"	5332A2001	5322A2001	5112A2003

Not available with metal bowl guard.



PIPE SIZE	MODEL NUMBERS	FILTER	CONSISTS OF REGULATOR WITH GAUGE 5400A2002	LUBRICATOR
	N	METAL GUARD OF	PLASTIC BOW	L
1/4" MIN.	5331A2005	5011A2007	5211A2006	5111A2007
1/4"	5331A2006	5011A2008	5211A2007	5111A2008
3/8"	5331A3006	5011A3008	5211A3007	5111A3008
1/2"	5331A4006	5011A4008	5211A4007	5111A4008
3/4"	5331A5006	5011A5008	5211A5007	5111A5008
		MET	AL BOWL	W/SIGHT GAUGE
1/4"	5332A2003	5012A2005	5211A2007	5112A2005
3/8″	5332A3003	5012A3005	5211A3007	5112A3005
1/2"	5332A4003	5012A4005	5211A4007	5112A4005
3/4"	5332A5003	5012A5005	5211A5007	5112A5005

#### FLOW MEDIA:

AMBIENT/MEDIA TEMPERATURE: Plastic Bowl — 130°F (54°C) Maximum. Metal Bowl — 180°F (82°C) Maximum.

REGULATED PRESSURE RANGE: 0 to 125 psig (0-8,8 kp/cm²). Bantam – 5 to 125 psig (0,3-8,8 kp/cm²).

INLET PRESSURE (MAXIMUM):

PLASTIC BOWL Bantam 150 psig

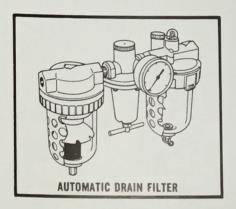
Manual Drain Filter

150 psig (10 kp/cm²) 150 psig (10 kp/cm²)

250 psig (17,6 kp/cm²)

METAL BOWL

SEE CAUTION - PAGE 35.



PIPE SIZE	MODEL NUMBERS	FILTER	CONSISTS OF REGULATOR WITH GAUGE 5400A2002	LUBRICATOR
	MI	TAL GUARD O	N PLASTIC BOY	WL
1/4"	5331A2007	5021A2008	5211A2007	5111A2008
3/8"	5331A3007	5021A3008	5211A3007	5111A3008
1/2"	5331A4007	5021A4008	5211A4007	5111A4008
3/4"	5331A5007	5021A5008	5211A5007	5111A5008
		7.77	ETAL DWL	W/SIGHT GAUGE
1/4"	5332A2004	5022A2005	5211A2007	5112A2005
3/8"	5332A3004	5022A3005	5211A3007	5112A3005
1/2"	5332A4004	5022A4005	5211A4007	5112A4005
3/4"	5332A5004	5022A5005	5211A5007	5112A5005

#### FLOW MEDIA:

AMBIENT/MEDIA TEMPERATURE: Plastic Bowl — 130°F (54°C) Maximum. Metal Bowl — 180°F (82°C) Maximum.

REGULATED PRESSURE RANGE: 0 to 125 psig (0-8,8 kp/cm²).

INLET PRESSURE (MINIMUM AND MAXIMUM):

Automatic Drain Filter

PLASTIC BOWL METAL BOWL 20 to 150 psig 20 to 175 psig (1,4 to 10 kp/cm²) (1,4 to 12 kp/cm²)



#### **MUFFLERS**

MUFFL-AIR®





#### STANDARD SPECIFICATIONS

Typical impact noise reduction achieved with a Ross MUFFL-AIR 20 to 25 db re 0.0002 microbar attenuation of impact noise for various size valves and various size load volumes.

#### SPEED CONTROL MUFFLER





#### STANDARD SPECIFICATIONS

Performs the combined function of a speed control and muffler. Not recommended for use with valves of poppet construction.

PIPE	MODEL NUMBERS		RALL ONS (mm) B
1/4"	5500A2001	.8 (20)	2.0 (51)
3/8"	5500A3001 5500A4001	1.3 (33)	3.3 (84)
3/4"	5500A5001 5500A6001	1.9 (48)	4.9 (124)
11/4"	5500A7001 5500A8001	2.5 (64)	5.9 (150)
2"	5500B9001	3.0 (76)	7.1 (180)
21/2"	5500A9002	4.0 (102)	6.6 (168)

PIPE SIZE	MODEL NUMBERS	OVER	ALL DIM B	ENSION C	S (mm)
1/4"	5500A2001	2.1 (53)	.6 (15)	1.7 (43)	1/4"
3/8"	5500A3001	2.7 (69)	.9	2.2 (56)	3/8"
1/2"	5500A4001	2.8 (71)	(23)	2.3 (58)	1/2"

#### **ACCESSORIES**

#### **BOWL GUARDS**



For protection in case of accidental bursting of polycarbonate bowl.

PIPE SIZE OF		BOWL GUARD
FILTER	LUBRICATOR	PART NO.
½" MIN.	1/4" MIN.	245K35
1/4"-3/8"-1/2"-11/4"-11/2"	1/4"-3/8"-1/2"	244K35
3/4"-1"	3/4"-1"-11/4"-11/2"	246K35

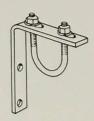
#### LUBRICATOR TAMPER PROOF CAP



Prevents unauthorized personnel from tampering with setting.

PART NUMBER 268K35

#### PIPE MOUNTING BRACKET



Bracket clamps over pipe or nipple and attaches rigidly to wall. Accommodates  $\frac{1}{4}$ " thru 1" pipe diameter.

PART NUMBER 124K82

#### LINE FILTER



Ideal for pilot line filtration. All brass construction with a replaceable cartridge.

PIPE SIZE	MODEL NO.
1/4"	5000A2001



Ross Operating Valve Company
120 E.Golden Gate Avenue · Detroit, Michigan 48203

# Oarker QUICK COUPLINGS



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#### WARREN ENGINEERING CORP.

2496 W. 2nd AVE. DENVER, COLO. 80223 (303) 936-8261

# HOW TO ORDER PARKER QUICK COUPLINGS

WHEN ORDERING PARKER COUPLER BODIES AND NIPPLES, PLEASE STATE THE FOLLOWING INFORMATION:

- CATALOG NUMBER of each type of coupler body and each type of nipple desired. List coupler bodies and nipples as separate items rather than in combinations. Be sure to double check thread or hose sizes of items required.
- ACTUAL QUANTITY of each item desired rather than boxes or packages.
- IF SPECIAL SEALS AND "O" RINGS ARE REQUIRED, place appropriate code letter after the unit catalog number as a suffix.

IF STANDARD NITRILE ELASTOMERIC (STD) seals and "O" rings are satisfactory for your application, no special notation is necessary. Standard seals and "O" rings will be supplied if your order does not indicate the need for specials. All steam couplers will be furnished with Ethylene Propylene seals (Code W) unless otherwise designated.

# WHERE TO BUY PARKER QUICK COUPLINGS

The Quick Coupling Division of Parker Hannifin maintains an extensive network of qualified stocking distributors located in most major metropolitan areas. To locate the Quick Coupling distributor serving your area, consult the yellow pages under couplings, hose and fittings or contact the nearest Parker Regional Sales office listed on the back cover of this catalog.

Our Parker Quick Coupling distributor is backed by inventories strategically located in Parker Hannifin factory warehouses. Parker's extensive warehouse system enables your distributor to provide you the finest in fast, dependable service.

Warranty covers material and workmanship only. ALL OTHER WARRANTIES, EXPRESS OR IMPLIED AND INCLUDING MERCHANTABILITY AND FITNESS FOR INTENDED PURPOSE, ARE EXPRESSLY EXCLUDED. Warranty expires 90 days after shipment and sole obligation thereunder is to repair or replace defective parts.



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HYDRAULIC VALVES, PUMPS &	DOUBLE A
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HYDRAULIC FILTERS	FAIREY
MOBILE HYDRAULIC VALVES	FLUID POWER SYSTEMS
ACCUMULATORS, HYDRAULIC VALVES	
TUBE & PIPE CLAMPS	
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SEALS  National "O" Rings
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The enclosed literature contains the information requested.

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SINGLE SHUT-OFF Fea	tures, Specifications, flow characteristics	6, 7	
Truflate design This nipple design, developed originally by Tru-Flate, has found wide usage throughout industry. Parker 10 Series couplers are made to fit it.		SERIES 10 1/4" 8, 9 3/8" 10, 11 1/2" 12, 13	
Industrial interchange		SERIES 20	
This is the nipple design adopted by most coupling manufacturers including Hansen, Aro, Foster, Breco, Dyna-Quip, Hoff-	sleeve type	1/4" 14, 15 3/8" 16, 17 1/2" 18, 19	
man, Lincoln, Schrader, etc. For that reason it is considered the industrial standard. Two series of Parker Couplers are made to fit it.	push type	SERIES 40 1/4" 20, 21 3/8" 22, 23	
Aro 210 interchange This nipple is characteristic of the Aro 210 Series and requires a coupler of matching design.		SERIES 50 24, 25	
Lincoln interchange This long nipple is the Lincoln long stem design and mates only with couplers of corresponding design.		SERIES 70 26, 27	
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ACCESSORIES

Line Filter

Air Fuse .....

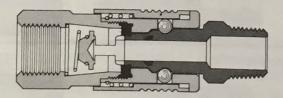
# How to select and size Parker quick couplings

When you find it necessary to uncouple a line at least once a week, chances are you can save money by using a quick coupling. Quick couplings are used to quickly and easily connect a flexible hose to another hose, or to rigid piping. They are designed to be connected and disconnected frequently by hand. Often they have a valve in one or both halves which automatically opens when the parts are joined and closes automatically when the parts are separated.

Quick couplings are available in various sizes and designs for use with different materials and at various pressures.

For most applications it is relatively easy to determine which type of coupling to use. Thereafter, one must take into consideration such factors as pipe and thread sizes, flow characteristics, types of end configurations, sealing materials, finishes, interchangeability, temperature, etc. These determinations may be made by references to the chart on page 4 and to the descriptions and specifications at the beginning of each section in this catalog.

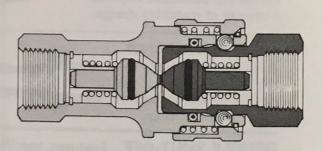
Three general types of quick couplings are commonly recognized:



Single Shut-off couplings were used originally for connecting portable air tools and equipment to compressed air lines. For that reason, they are often referred to as "pneumatic" couplings. However, now they are used on many other applications. as well. Single shut-off couplings are usually built to withstand operating pressures up to 300 psi.

Where noncompressible fluids such as water, oil, and grease are being used, this pressure may sometimes be exceeded safely. Body sizes are compatible with 1/4, 3/8, and 1/2 inch pipe and hose.

The coupler body should be installed on the upstream (supply) end of the line to shut off the fluid supply when coupling is disconnected. The nipple has no valving and upon disconnection, exhausts the downstream media. Even in a liquid line, this would not be mechanically detrimental unless fluid loss would interfere with a holding circuit or contaminate the area around it.

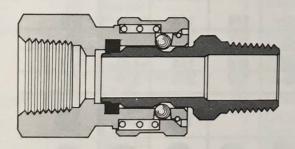


Double Shut-off couplings are designed for connecting hydraulic lines. For that reason, they are frequently called "hydraulic" couplings. Although that is still their main application, they are also used extensively where a variety of other fluids are involved. They are made to withstand pressures from 800 to 5000 psi, depending on size and material. (Manufacturer's specifications should always be checked for correct application.) They contain valves in both the female and male halves to prevent loss of fluid when the parts are disconnected.

It is recommended that when the coupling is disconnected a dust cap be placed over the nipple (male half) and a dust plug be placed inside the coupler body (female half). These dust caps and plugs are designed by each manufacturer to work

in conjunction with their couplings. They not only help prevent contamination to the media when lines are reconnected, but also increase the life of the coupling by preventing damage when being handled or stored.

Parker double shut-off couplings are available in brass, steel, and 316 stainless steel, with a range of body sizes from 1/8" to 1 1/2". Stainless steel Series 60 couplers are machined from the highest quality 316 bar stock. They are excellent for use with corrosive fluids, in a corrosive atmosphere or where sanitary requirements dictate super clean performance. All Parker stainless couplers are electropolished for ease in cleaning and superior appearance.



Strait-Thru couplings are designed without valves to provide the least resistance to fluid flow. Therefore, they require manual shut-off valves in both lines if fluid loss is to be prevented when the couplings are disconnected.

Coupler bodies of this design are manufactured in brass and 316 stainless steel. Strait-thru nipples are cataloged in brass, steel, and stainless steel. 316 stainless, having the highest index of corrosion resistance in the 300 series stainless steels, permits these couplers to be used in the most demanding chemical transfer applications. The wide range of sizes, from the miniature 1/8" to the hefty 1 1/2" allows their employment in fields ranging from instrumentation to steelmaking.

# SIZING PARKER QUICK COUPLINGS

WHEN SIZING A PARKER QUICK COUPLER FOR YOUR REQUIREMENTS YOU MUST CON-SIDER SIZE FACTORS WHEN MAKING YOUR DECISION.

- 1. **VALVING** Determine the type of valving you need, considering the acceptability of fluid loss and safety.
- 2. **PRESSURE** Determine the working pressure of the system and whether surge or shock conditions are present. Select those couplings with working pressures compatable with your system.
- 3. **FLOW** Determine the volume of fluid to be delivered through the coupling at the working pressure of the system.
- 4. PRESSURE DROP Using the charts provided, for each coupling series in the catalog. pressure drop ( $\triangle$  P) for each coupling size can be determined. Simply compare flow rate vs. pressure in each size to find the coupling which meets your requirements. Remember, pressure drop is cumulative.
- 5. **MATERIALS** Using the media chart (page 5) determine what seal material is compatable with the fluid and temperature in the system. The type of fluid will also influence the type of metal you select.
- 6. AMBIENT CONDITIONS External conditions such as temperature, corrosive vapors and other factors should also be considered in the selection since they may affect the operation of the coupler.

# Parker QUICK COUPLINGS **QUICK REFERENCE GUIDE**

KEY: Standard	6	Semi	-Stan	dard	C	Option	nal			
VALVING TYPE	SII	NGLE	SHU.	T-OFF	s	DOU	BLE SH	UT-OFFS		STRAIT THRU
Series	10	20	40	50	70	60	4600	3000	5000	ST
METALS <sup>1</sup> : Steel	•			•	•	•	•	•	•	• <sup>2</sup>
Brass with Steel Sleeve	0					0				6
Brass with Brass Sleeve	0	0				•				•
Stainless Steel (316)						•				•
SEALS: Metal								•		on the same
Resilient Buna-N	•	•		•	•	•	•	•		•
Neoprene	0	0	0	0		0	0			0
EPR	0	0	0	0		0	0	ale grain		0
Viton	0	0	0	0		0	0			0
BODY SIZE Min. Max.		1/4	1/4	1/4	1/4	1/8	1/4	1/4 3/8	1/2	1/8
THREAD SIZE Min. Max.	1/8 3/4		1/8	1/8 3/8	1/8 3/8	1/8	1/4	1/4 3/8	1/2 3/4	1/8
END FITTINGS Male Pipe	•			•		-	-			
Female Pipe	0	0				0	•	0		
Std. Hose Barb		0								o destroyen
Push-Lok Hose Barb	•			•				o tertan		
Reusable	0	•								
PRESSURE <sup>3</sup> :	300	300	300	300	300	5000	2000	10,000	612	1200
VACUUM <sup>4</sup>	0					0				
SLEEVE-LOCK	0	-	0	0	0	0				

Type of metal determined by media, temperature, pressure

Male half only. Female half available in steel as a special,

Static pressure

See complete pressure charts for each series for detailed information.

If vacuum is specified on order, we will test each coupling. Slight service fee added.

<sup>1 1/4&</sup>quot; and 1 1/2" sizes only.

# **50** SERIES Aro 210 series

Parker Series 50 couplings are made to interchange with the "210 Series" manufactured by Aro. Available in 1/4" size and three end configurations, they feature a full-opening tubular valve design that permits maximum flow while protecting and supporting the seal. Built-in sleeve guard minimizes accidental disconnect. Standard seal material is Buna-N. for operating temperatures of -400 to +2500 F. See page 5 for optional seal materials and their temperature ranges.

SPECIFICATIONS	В	ODY	SIZE	1
	1/4			
Working Pressure (psig)	300			
Temperature Range (1)		to +	2500	F.
Locking Device				
Force Required to Connect (lbs)				
With 80 psi initial pressure	13			
With 100 psi initial pressure	15			
Vacuum Data (2) (inches Hg)				
Disconnected (coupler only)N	lot Re	comn	nende	d
Connected				_

# 70 SERIES Lincoln "Long-Stem"

Parker 70 Series couplings are made to interchange with the "Long Stem" Series manufactured by Lincoln. Full-opening tubular valve design permits maximum flow while protecting and supporting the seal. Available in 1/4" size, in three end configurations. Built in sleeve guard minimizes accidental disconnect. Standard seal material is Buna-N, for operating temperatures of -40° to +250° F.

SPECIFICATIONS	BODY SIZE
Working Pressure (psig)	300
Temperature Range	,-400 to +2500 F.
Locking Device	
Force Required to Connect (Ibs)	
With 80 psi initial pressure	8
With 100 psi initial pressure	10
Vacuum Data (2) (inches Hg)	
Disconnected (coupler only)N	ot Recommended
Connected	27.4

### AIR FLOW CHARACTERISTICS (Coupler and nipple connected)

SERIES	BODY	INLET			AIR	FLOW IN	CUBIC FE		MINUTE (	SCFM)		
	SIZE	PRESSURE	2	4	6	8	10	12	14	16	18	20
	0.22	(PSIG)		PRESSURE DROP (PSIG)								
		80	13.9	19.9	24.3	27.6	30.8	33.7	35.6	37.2	38.5	39.5
	1/4	100	15.8	23.3	27.8	31.8	34.8	37.4	39.9	42.2	44.0	45.6
		80	21.9	34.6	42.4	49.0	54.5	58.8	62.3	65.9	69.0	73.0
10	3/8	100	27.0	39.4	48.0	54.4	60.6	65.0	69.9	74.2	77.3	81.1
		80	36.6	57.6	77.0	84.9	104.5	113.0	119.0	124.9	129.7	134.6
	1/2	100	44.9	71.2	87.7	104.2	117.7	127.1	134.1	141.8	147.1	151.2
		80	12.2	17.9	22.2	25.9	28.6	31.2	33.3	34.6	36.1	37.6
	1/4	100	13.6	20.4	25.4	29.2	32.0	34.9	37.3	39.4	41.7	42.9
20 3/8	80	19.8	31.7	39.7	45.7	50.5	55.9	59.0	62.0	64.9	67.4	
	100	22.9	38.5	43.9	50.8	56.6	61.2	65.9	69.9	73.1	76.5	
		80	36.6	57.6	77.0	84.9	104.5	113.0	119.0	124.9	129.7	134.6
	1/2	100	44.9	71.2	87.7	104.2	117.7	127.1	134.1	141.8	147.1	151.2
		80	12.1	18.2	22.2	25.6	28.8	31.4	33.1	34.9	36.1	37.4
	1/4	100	13.2	20.9	25.2	29.3	32.3	35.2	36.8	39.6	41.4	42.9
40		80	23.6	30.9	40.0	46.0	51.6	56.3	59.3	63.5	66.3	68.5
	3/8	100	28.1	37.1	45.0	51.5	56,4	62.4	67.5	71.0	73.8	76.8
		THE RESERVE THE PERSON NAMED IN COLUMN TWO IS NOT THE OWNER.	12.7	17.5	21.5	24.8	28.1	30.3	32.0	34.0	35.4	36.6
50	1/4	80 100	13.4	19.5	24.5	28.2	31.4	33.8	36.4	38.2	40.2	41.9
		80	11.7	16.8	21.3	24.2	27.4	29.8	31.7	33.3	34.8	36.1
70	1/4	100	13.9	19.1	24.0	27.6	30.6	33.3	35.5	37.9	39.9	41.4

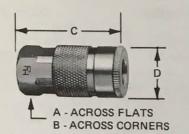
<sup>(1)</sup> Couplings with standard seals, see page 5 for temperature ranges of special seals.

<sup>(2)</sup> Couplers for vacuum service should be 100% lab tes-There is an extra charge for this service.



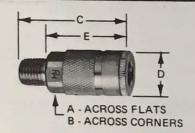
Couplers on this page will mate with any 10 Series 1/4" nipple regardless of end connection.

Approximate connected length of coupler and nipple, C + L.



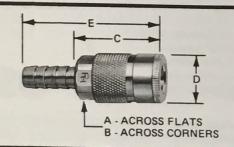
#### FEMALE PIPE THREAD

PART	IUMBER	THREAD SIZE	DIMENSIONS				
STEEL	BRASS*	N.P.T.	A	В	C	D	
13A	B13A	1/8-27	.75	.87	1.83	.88	
13	B13	1/4-18	.75	.87	1.83	.88	
13E	B13E	3/8-18	.81	.94	1.89	.88	



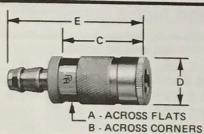
#### MALE PIPE THREAD

PART NUMBER SIZE		THREAD SIZE	DIMENSIONS						
STEEL	BRASS*	N.P.T.	A	В	C	D	E		
12A	B12A	1/8-27	.75	.80	1.89	.88	1.52		
12	B12	1/4-18	.75	.80	2.05	.88	1.52		
12E	B12E	3/8-18	.75	.80	2.08	.88	1.52		



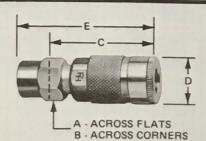
#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS					
STEEL	I.D.	A	В	C	D	E	
10-3B 10-4B	1/4"	.75	.80	1.52	.88	2.48	
10-4B	5/16" 3/8"	.75 .75	.80	1.52 1.52	.88	2.48	



#### PUSH-LOK HOSE BARB

PART NUMBER STEEL	HOSE		[	DIMENSIC	ONS	
	I.D.	A	В	C	D	E
10-3BP 10-5BP	1/4" 3/8"	.75 .75	.80 .80	1.50 1.52	.88	2.31 2.47



### REUSABLE HOSE FITTINGS

PART NUMBER	HOSE		DIMENSIONS					
STEEL 12-C3	I.D.	0.D.	A	В	C	D	E	
12-C4 12-C5 12-C6	1/4 1/4 1/4 1/4	1/2 17/32 9/16 5/8	.69 .75 .75	.79 .87 .87	1.83 1.83 1.83 1.83	.88 .88 .88	2.45 2.45 2.45 2.45	

Steel Grip Ring Sleeves are available for all 10 Series Couplers. See page 34 for details.

FEATURES, SPECIFICATIONS AND AIR FLOW CHARACTERISTICS-PAGES 6 AND 7.

Brass couplers have cadmium plated steel valves, zinc plated steel sleeves, stainless steel balls and springs. To specify brass sleeve and valve, add suffix letter N to model number. Example:

Tru-Flate design nipples 10 SERIES

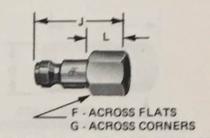
1/4" nipples

Nipples on this page will mate with any 10 Series 1/4" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

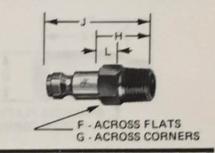
#### **FEMALE PIPE THREAD**

PART N	UMBER	THREAD SIZE	DIMENSIONS				
STEEL	BRASS	N.P.T.	F	G	J	L	
1C		1/8-27	.50	.58	1.28	.44	
3C	B3C	1/4-18	.63	.72	1.41	.56	
3C-E		3/8-18	.81	.94	1.50	.66	



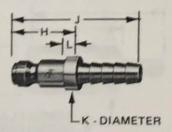
#### MALE PIPE THREAD

PART NUMBER		THREAD	DIMENSIONS				THE
STEEL	BRASS	N.P.T.	F	G	Н	J	L
OC		1/8-27	.50	.58	.63	1.47	.25
2C	B2C	1/4-18	.56	.65	.78	1.63	.25
2C-E		3/8-18	.69	.79	.88	1.72	.31



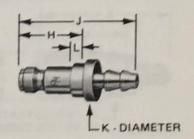
#### STANDARD HOSE BARB

PART NUMBER	HOSE		DIMENSIONS				
STEEL	1.D.	Н	J	K	L		
8C	1/4"	1.03	2.00	.56	.19		
8C-D	5/16"	1.03	2.00	.56	.19		
9C	3/8"	1.03	2.00	.56	.19		



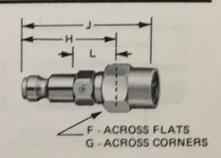
#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE		DIMEN	IMENSIONS		
STEEL	I.D.	Н	J	K	L	
8CP	1/4"	1.03	1.83	.69	.19	
9CP	3/8"	1.03	1.98	.86	:19	



#### REUSABLE HOSE FITTINGS

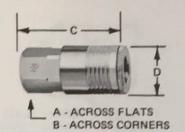
PART NUMBER	+	IOSE	DIMENSIONS				
STEEL	1.D.	O.D.	F	G	Н	J	L
8C-C3 8C-C4	1/4 1/4	1/2 17/32	.69 .75	.79 .87	1.47	2.09	.63 .63
8C-C5 8C-C6	1/4	9/16 5/8	.75 .81	.87	1.47	2.09	.63





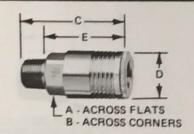
Couplers on this page will mate with any 10 Series 3/8" nipple

Approximate connected length of coupler and nipple, C + L.



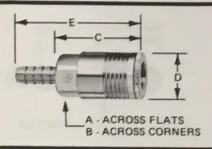
#### FEMALE PIPE THREAD

PART NUMBER SIZE			DIMENSIONS					
STEEL	BRASS*	N.P.T.	A	В	C	D		
15C	B15C	1/4-18	.88	1.01	2.22	1.06		
15	B15	3/8-18	.88	1.01	2.28	1.06		
15F	B15F	1/2-14	1.00	1.15	2.55	1.06		



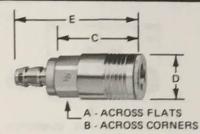
#### MALE PIPE THREAD

PART NUMBER SIZE		DIMENSIONS					
STEEL	BRASS*	N.P.T.	A	В	C	D	E
14C	B14C	1/4-18	.88	.96	2.36	1.06	1.83
14	B14	3/8-18	.88	.96	2.39	1.06	1.83
14F	B14F	1/2-14	.88	.96	2.55	1.06	1.83



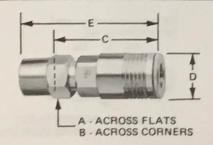
#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS					
STEEL	1.D.	A	В	C	D	E	
14-3B	1/4"	.88	.96	1.89	1.06	2.86	
14-5B	3/8"	.88	.96	1.89	1.06	2.86	
14-6B	1/2"	.88	.96	1.86	1.06	3.86	



#### PUSH-LOK HOSE BARR

PART NUMBER	HOSE		[	DIMENSIO	ONS	
STEEL	I.D.	A	В	С	D	E
14-3BP 14-5BP 14-6BP	1/4" 3/8" 1/2"	.88 .88	.96 .96	1.91 1.92 1.89	1.06 1.06 1.06	2.72 2.88 2.98



#### REUSABLE HOSE FITTINGS

PART NUMBER	HC	OSE	DIMENSIONS				
STEEL	I.D.	0.D.	A	В	-	T =	E
14-D5 14-D6 14-D7 14-D8 14-D9	5/16 5/16 5/16 5/16 5/16 5/16	9/16 5/8 21/32 11/16 23/32 3/4	.75 .81 .88 .88 .94	.87 .94 1.01 1.01 1.08 1.08	2.20 2.20 2.20 2.20 2.20 2.20 2.20	1.06 1.06 1.06 1.06 1.06	2.89 2.89 2.89 2.89 2.89 2.89

Steel Grip Ring Sleeves are available for all 10 Series Couplers. See page 34 for details.

Brass couplers have cadmium plated steel valves, zinc plated steel sleeves, stainless steel balls and springs. To specify brass sleeve and valve, add suffix letter N to model number. Example: B15N

Nipples on this page will mate with any 10 Series 3/8" coupler regardless of end connection.

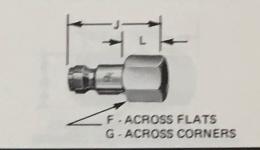
Approximate connected length of coupler and nipple, C + L.

# Tru-Flate design nipples 10 SERIES 3/8" nipples 10 nipples



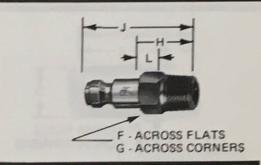
#### FEMALE PIPE THREAD

PART NUMBER		THREAD SIZE	DIMENSIONS			
STEEL	BRASS	N.P.T.	F	G	J	L
01E		1/8-27	.63	.72	1.38	.34
1E		1/4-18	.63	.72	1.59	.56
3E	B3E	3/8-18	.81	.94	1.69	.66



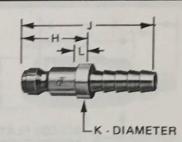
#### MALE PIPE THREAD

PART N	UMBER	THREAD SIZE		DI	MENSIO	NS	
STEEL	BRASS	N.P.T.	F	G	Н	J	L
00E		1/8-27	.63	.72	.63	1.66	.25
0E		1/4-18	.63	.72	.84	1.88	.31
2E	B2E	3/8-18	.69	.79	.88	1.91	.31



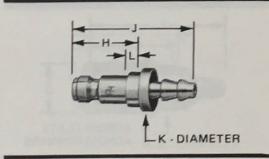
#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS					
STEEL	1.D.	Н	J	K	L		
4E	1/4"	1.22	2.19	.63	.19		
5E	3/8"	1.22	2.19	.63	.19		
6E	1/2"	1.59	3.22	.88	.56		



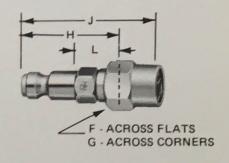
#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE		DIMEN	SIONS	
STEEL	I.D.	Н	J	K	L
4EP 5EP	1/4"	1.22	2.02	.69 .86	.19
6EP	1/2"	1.22	2.31	.97	.19



#### REUSABLE HOSE FITTINGS

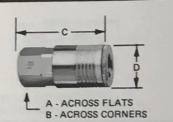
PART NUMBER	Н	OSE		DIN	IENSION	S	
STEEL	1.D.	O.D.	F	G	Н	J	-
7E-D5	5/16	9/16	.75	.87	1.66	2.34	.63
7E-D6	5/16	5/8	.81	.94	1.66	2.34	.63
7E-D7	5/16	21/32	.88	1.01	1.66	2.34	.63
7E-D8	5/16	11/16	.88	1.01	1.66	2.34	.63
7E-D6	5/16	23/32	.94	1.08	1.66	2.34	.63
7E-D9	5/16	3/4	.94	1.08	1.66	2.34	.63
7E-E6	3/8	5/8	.88	1.01	1.66	2.59	.63
	3/8	21/32	.88	1.01	1.66	2.59	.63
7E-E7			.88	1.01	1.66	2.59	.63
7E-E8	3/8	11/16	.94	1.08	1.66	2.59	.63
7E-E9 7E-E10	3/8	23/32	.94	1.08	1.66	2.59	.63



# 10 SERIES Tru-Flate design couplers 1/2" couplers Couplers on this page will mate with 1/2" nipple regardless of end connections.

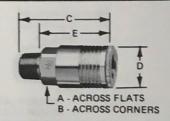
Couplers on this page will mate with any 10 or 20 Series 1/2" nipple regardless of end connection.

Approximate connected length of coupler and nipple, C+L.



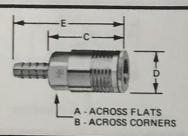
#### FEMALE PIPE THREAD

		THREAD		DIMEN	ISIONS	
STEEL	BRASS*	N.P.T.	A	В	C	D
17E	B17E	3/8-18	1.00	1.15	2.73	1.19
17	B17	1/2-14	1.00	1.15	2.95	1.19
17G	B17G	3/4-14	1.25	1.44	3.19	1.19



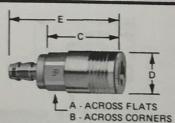
#### MALE PIPE THREAD

PART NUMBER		THREAD		D	IMENSIC	NS	
STEEL	BRASS*	N.P.T.	A	В	C	D	E
16E	B16E	3/8-18	1.00	1.15	2.95	1.19	2.39
16	B16	1/2-14	1.00	1.15	3.08	1.19	2.36
16G	B16G	3/4-14	1.13	1.30	3.20	1.19	2.42



#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS					
STEEL	I.D.	A	В	C	D	E	
16-5B 16-6B	3/8" 1/2"	1.00	1.15	2.39	1.19	3.36 4.39	
16-7B	3/4"	1.00	1.15	2.89	1.19	4.77	



#### PUSH-LOK HOSE BARB

STEEL STEEL	HOSE		D	IMENSIC	NS	
	I.D.	A	В	C	D	E
16-5BP 16-6BP	3/8" 1/2"	1.00	1.15 1.15	2.42 2.44	1.19	3.38 3.53

Steel Grip Ring Sleeves are available for all 10 Series Couplers, See page 34 for details,

FEATURES, SPECIFICATIONS AND AIR FLOW CHARACTERISTICS-PAGES 6 AND 7.

Brass couplers have cadmium plated steel valves, zinc plated steel sleeves, stainless steel balls and springs. To specify brass sleeve and valve, add suffix letter N to model number. Example:

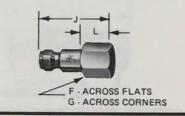
Tru-Flate design nipples 10 SERIES 1/2" nipples 1/2" nipples

Nipples on this page will mate with any 10 or 20 Series 1/2" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

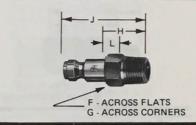
#### FEMALE PIPE THREAD

PART NUMBER		THREAD SIZE		DIMEN	ISIONS	7.754%
STEEL	BRASS	N.P.T.	F	G	J	L
1F 3F	DOF	3/8-18 1/2-14	.81	.94	2.05	.66
3F-G	B3F	3/4-14	1.00	1.15	2.27 2.39	1.00



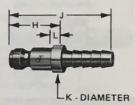
#### MALE PIPE THREAD

PART NUMBER		THREAD SIZE		D	IMENSION	NS	
STEEL	BRASS	N.P.T.	F	G	Н	J	L
OF		3/8-18	.69	.79	.94	2.33	.38
2F	B2F	1/2-14	.88	1.01	1.09	2.48	.44
2F-G		3/4-14	1.13	1.30	1.16	2.55	.38



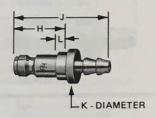
#### STANDARD HOSE BARB

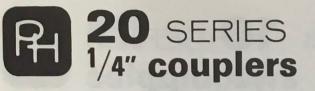
PART NUMBER	HOSE	DIMENSIONS					
STEEL	I.D.	Н	J	K	L		
4F	3/8"	1.58	2.55	.69	.19		
5F	1/2"	1.95	3.58	.88	.56		
5F-G	3/4"	2.05	3.92	1.00	.66		



#### **PUSH-LOK HOSE BARB**

PART NUMBER	HOSE		DIMEN:	SIONS	
STEEL	I.D.	Н	J	K	L
4FP	3/8"	1.58	2.53	.86	.19
5FP	1/2"	1.58	2.68	.97	.19

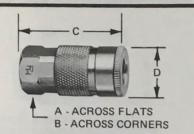




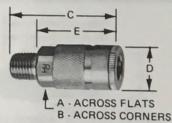
# SERIES Industrial interchange sleeve type couplers

Couplers on this page will mate with any 20 or 40 Series 1/4" nipple regardless of end connection.

Approximate connected length of coupler and nipple, C + L.



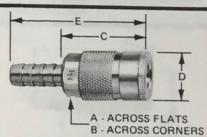
Annual of the same		THREAD		DIME	NSIONS	
STEEL	BRASS*	N.P.T.	A	В	C	D
23A	B23A	1/8-27	.75	.87	1.83	.88
23	B23	1/4-18	.75	.87	1.83	.88
23E	B23E	3/8-18	.81	94	1 89	99



#### MALE PIPE THREAD

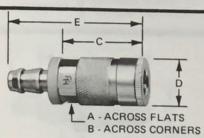
**FEMALE PIPE THREAD** 

PART NUMBER		THREAD SIZE			DIMENSI	ONS	
STEEL	BRASS*	N.P.T.	A	В	C	D	E
22A	B22A	1/8-27	.75	.80	1.89	.88	1.52
22	B22	1/4-18	.75	.80	2.05	.88	1.52
22E	B22E	3/8-18	.75	.80	2.08	.88	1.52



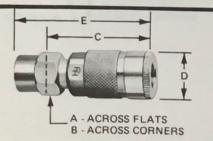
#### STANDARD HOSE BARB

PART NUMBER	HOSE		[	DIMENSIC	ONS	
STEEL	I.D.	A	В	C	D	E
20-3B 20-4B	1/4"	.75	.80	1.52	.88	2.48
20-5B	5/16" 3/8"	.75 .75	.80	1.52 1.52	.88	2.48



#### PUSH-LOK HOSE BARB

PART NUMBER STEEL	HOSE		DIMENSIONS					
20-3BP 20-5BP	I.D.	A	В	C	D	E		
	1/4" 3/8"	.75 .75	.80	1.50 1.52	.88	2.31 2.47		



### REUSABLE HOSE FITTINGS

PART NUMBER	НС	SE					
STEEL	I.D.	0.D.			DIMENSI	ONS	
22-C3	1/4		A	В	C	D	E
22-C4		1/2	.69	.79	1.83	.88	2.45
22-C5	1/4	17/32	.75	.87	1.83	.88	2.45
22-C6	1/4	9/16	.75	.87	1.83	.88	2.45
	1/4	5/8	.81	.94	1.83	.88	2.45
22-D5 22-D6 22-D7 22-D8 22-D9 22-D10	5/16 5/16 5/16 5/16 5/16 5/16	9/16 5/8 21/32 11/16 23/32 3/4	.75 .81 .88 .88 .94	.88 .94 1.01 1.01 1.08 1.08	1.83 1.83 1.83 1.83 1.83 1.83	.88 .88 .88 .88	2.52 2.52 2.52 2.52 2.52 2.52 2.52
22-E6 22-E7 22-E8 22-E9 22-E10	3/8 3/8 3/8 3/8 3/8	5/8 21/32 11/16 23/32 3/4	.88 .88 .88 .94	1.01 1.01 1.01 1.08 1.08	1.83 1.83 1.83 1.83 1.83	.88 .88 .88 .88 .88	2.77 2.77 2.77 2.77 2.77 2.77

Steel Grip Ring Sleeves are available for all 20 Series Couplers. See page 34 for details,

FEATURES, SPECIFICATIONS AND AIR FLOW CHARACTERISTICS--PAGES 6 AND 7.

 Brass couplers have cadmium plated steel valves, zinc plated steel sleeves, stainless steel balls and springs. To specify brass sleeve and valve, add suffix letter N to model number. Example: B23N

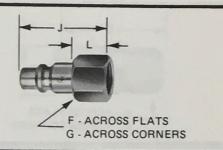
# Industrial interchange sleeve type nipples

Nipples on this page will mate with any 20 or 40 Series 1/4" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

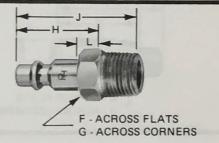
# 20 SERIES 1/4" nipples

				FEMAL	E PIPE	IHKEAD		
PART N	UMBER	THREAD SIZE	DIMENSIONS					
STEEL	BRASS	N.P.T.	F	G	J	L		
H1C		1/8-27	.50	.58	1.38	.44		
НЗС	BH3C	1/4-18	.63	.72	1.50	.56		
<b>Н3С-Е</b>		3/8-18	.81	.94	1.59	.66		



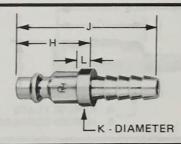
#### MALE PIPE THREAD

PART N	UMBER	THREAD SIZE		DIM	ENSIONS		
STEEL	BRASS	· N.P.T.	F	G	Н	J	L
HOC		1/8-27	.50	.58	.63	1.56	.25
H2C	BH2C	1/4-18	.56	.65	.78	1.72	.25
H2C-E		3/8-18	.69	.79	.88	1.81	.31



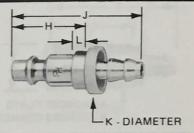
#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS				
STEEL	I.D.	Н	J	K	L	
H8C	1/4"	1.13	2.09	.56	.19	
H8C-D	5/16"	1.13	2.09	.56	.19	
H9C	3/8"	1.13	2.09	.56	.19	



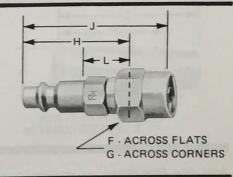
#### **PUSH-LOK HOSE BARB**

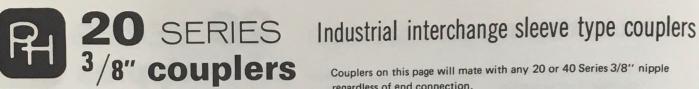
PART NUMBER	HOSE	DIMENSIONS				
STEEL	I.D.	Н	J	K	L	
H8CP	1/4"	1.13	1.93	.69	.19	
H9CP	3/8"	1.13	2.08	.86	.19	



#### RELISABLE HOSE FITTINGS

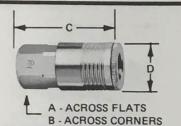
	REUSABLE HOUL THITMES									
PART NUMBER	Н	OSE		DII	MENSION	IS				
STEEL	I.D.	O.D.	F	G	Н	J	L			
H8C-C3	1/4	1/2	.69	.79	1.56	2.19	.63			
H8C-C4	1/4	17/32	.75	.87	1.56	2.19	.63			
H8C-C5	1/4	9/16	.75	.87	1.56	2.19	.63			
H8C-C6	1/4	5/8	.81	.94	1.56	2.19	.63			
H8C-D5	5/16	9/16	.75	.87	1.56	2.25	.63			
H8C-D6	5/16	5/8	.81	.94	1.56	2.25	.63			
H8C-D7	5/16	21/32		1.01	1.56	2.25	.63			
H8C-D8	5/16	11/16	.88	1.01	1.56	2.25	.63			
H8C-D9	5/16	23/32	.94	1.08	1.56	2.25	.63			
H8C-D10	5/16	3/4	.94	1.08	1.56	2.25	.63			
H8C-E6	3/8	5/8	.88	1.01	1.63	2.56	.69			
H8C-E7	3/8	21/32	The state of the s	1.01	1.63	2.56	.69			
H8C-E8	3/8	11/16	.88	1.01	1.63	2.56	.69			
H8C-E9	3/8	23/32	.94	1.08	1.63	2.56	.69			
H8C-E10	3/8	3/4	.94	1.08	1.63	2.56	.69			





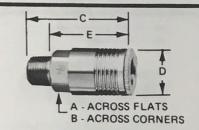
regardless of end connection.

Approximate connected length of coupler and nipple, C + L.



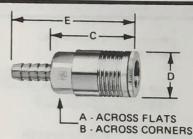
#### **FEMALE PIPE THREAD**

PART	IUMBER	THREAD	DIMENSIONS				
STEEL	BRASS*	N.P.T.	A	В	C	D	
25C	B25C	1/8-27	.88	1.01	2.22	1.06	
25	B25	1/4-18	.88	1.01	2.28	1.06	
25F	B25F	3/8-18	1.00	1.15	2.55	1.06	



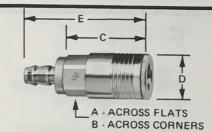
#### MALE PIPE THREAD

PART NUMBER SIZE			DIMENSIONS					
STEEL	BRASS*	N.P.T.	A	В	C	D	E	
24C	B24C	1/8-27	.88	.96	2.36	1.06	1.83	
24	B24	1/4-18	.88	.96	2.39	1.06	1.83	
24F	B24F	3/8-18	.88	.96	2.55	1.06	1.83	



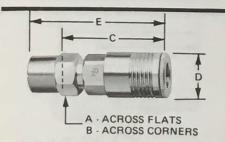
#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS					
STEEL	I.D.	A	В	C	D	E	
24-3B 24-5B 24-6B	1/4" 5/16" 3/8"	.88 .88 .88	.96 .96	1.89 1.89 1.86	1.06 1.06 1.06	2.86 2.86 2.86	



#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE	DIMENSIONS					
STEEL	I.D.	A	В	C	D	E	
24-3BP 24-5BP 24-6BP	1/4" 3/8" 1/2"	.88 .88 .88	.96 .96	1.91 1.92 1.89	1.06 1.06 1.06	2.72 2.88 2.98	



### REUSABLE HOSE FITTINGS

PART NUMBER	НС	OF.					
STEEL		SE		[	DIMENSIC	ONS	
	I.D.	O.D.	A	В	С	D	E
24-C3	1/4	1/2	.69	.79	2.20	1.06	2.83
24-C4	1/4	17/32	.75		The state of the s		
24-C5	1/4	9/16		.87	2.20	1.06	2.83
24-C6	1000		.75	.87	2.20	1.06	2.83
2400	1/4	5/8	.81	.94	2.20	1.06	2.83
24-D5	5/16	9/16	1 7-	1			
24-D6	200000000000000000000000000000000000000	The second secon		.87	2.20	1.06	2.89
24-D7	5/16	5/8	.81	.94	2.20	1.06	2.89
24-D8	5/16	21/32	.88	1.01	2.20	1.06	2.89
	5/16	11/16	.88	1.01	2.20	1.06	2.89
24-D9	5/16	23/32	.94	C. C			-
24-D10	5/16	3/4	110000000000000000000000000000000000000	1.08	2.20	1.06	2.89
04.00	1 0/10	3/4	.94	1.08	2.20	1.06	2.89
24-E6	3/8	5/8	.88	1.01	1 000	1	1 2 14
24-E7	3/8	21/32	The second second		2.20	1.06	3.14
24-E8	3/8		.88	1.01	2.20	1.06	3.14
24-E9		11/16	.88	1.01	2.20	1.06	3.14
24-E10	3/8	23/32	.94	1.08	2.20	1.06	3.14
24-510	3/8	3/4	.94	1 08	2.20	1.06	3 14

Steel Grip Ring Sleeves are available for all 20 Series Couplers. See page 34 for details.

<sup>\*</sup> Brass couplers have cadmium plated steel valves, zinc plated steel sleeves, stainless steel balls and springs. To specify brass sleeve and valve, add suffix letter N to model number. Example: **B25N** 

# Industrial interchange sleeve type nipples

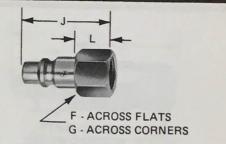
Nipples on this page will mate with any 20 or 40 Series 3/8" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

# 20 SERIES | 3/8" nipples

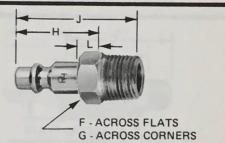
#### FEMALE PIPE THREAD

PART N	IUMBER	THREAD SIZE		DIMENS	SIONS	
STEEL	BRASS	N.P.T.	F	G	J	L
H01E		1/8-27	.63	.72	1.38	.34
H1E		1/4-18	.63	.72	1.59	.56
H3E	BH3E	3/8-18	.81	.94	1.69	.66
H3E-F		1/2-14	1.00	1.15	1.84	.81



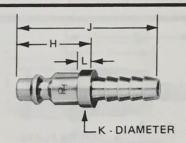
#### MALE PIPE THREAD

PART NUMBER		THREAD SIZE		DIN	MENSION	S	
STEEL	BRASS	N.P.T.	F	G	Н	J	L
H00E		1/8-27	.63	.69	.69	1.72	.31
H0E		1/4-18	.63	.72	.84	1.88	.31
H2E	BH2E	3/8-18	.69	.79	.88	1.91	.31
H2E-F		1/2-14	.88	1.01	1.09	2.13	.38



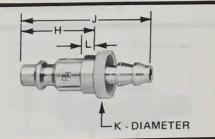
#### STANDARD HOSE BARB

PART NUMBER	HOSE	DIMENSIONS				
STEEL	I.D.	Н	J	K	L	
H4E	1/4"	1.22	2.19	.63	.19	
H5E	5/16"	1.22	2.19	.63	.19	
H6E	3/8"	1.59	3.22	.88	.56	



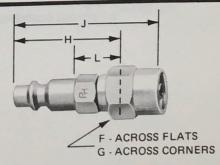
#### **PUSH-LOK HOSE BARB**

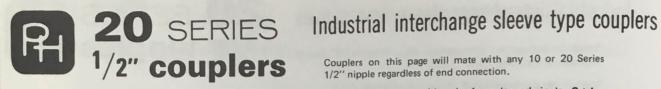
DADE				10110	
PART NUMBER	HOSE		IONS		
STEEL	I.D.	Н	J	K	L
H4EP	1/4"	1.22	2.02	.69	.19
H5EP	3/8"	1.22	2.17	.86	.19
H6EP	1/2"	1.22	2.31	.97	.19



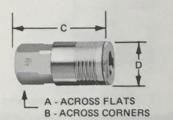
### REUSABLE HOSE FITTINGS

				- Control of the last of the l			
PART NUMBER	Н	OSE		DII	MENSION	S	
STEEL	I.D.	O.D.	F	G	Н	J	L
H6E-C3	1/4	1/2	.69	.79	1.66	2.28	.63
H6E-C4	1/4	17/32	.75	.87	1.66	2.28	.63
H6E-C5		9/16	.75	.87	1.66	2.28	.63
H6E-C6	1/4			.94	1.66	2.28	.63
1105-00	1/4	5/8	.81	.54			00
H7E-D5	5/16	9/16	.75	.87	1.66	2.34	.63
H7E-D6	5/16	5/8	.81	.94	1.66	2.34	.63
H7E-D7		21/32	.88	1.01	1.66	2.34	.63
H7E-D8	5/16		1 5 DESTRU	1.01	1.66	2.34	.63
H7E-D9	5/16	11/16	.88		1.66	2.34	.63
H7E-D9	5/16	23/32	.94	1.08	1.66	2.34	.63
H7E-D10	5/16	3/4	.94	1.08	1.00		00
H7E-E6	3/8	5/8	.88	1.01	1.66	2.59	.63
H7E-E7		21/32	.88	1.01	1.66	2.59	.63
H7E-E8	3/8		The second second	1.01	1.66	2.59	.63
H7E-E9	3/8	11/16	.88	1.08	1.66	2.59	.63
H7E-E9	3/8	23/32	.94		1.66	2.59	.63
7/E-F10	3/2	1 2/A	04	1.08	1.00		



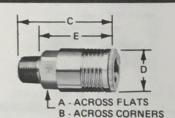


Approximate connected length of coupler and nipple, C + L.



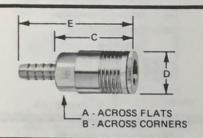
#### **FEMALE PIPE THREAD**

PART NUMBER		THREAD		DIMEN	ISIONS	
STEEL	BRASS*	N.P.T.	A	В	C	D
17E	B17E	3/8-18	1.00	1.15	2.73	1.19
17	B17	1/2-14	1.00	1.15	2.95	1.19
17G	B17G	3/4-14	1.25	1.44	3.19	1.19



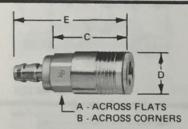
#### MALE PIPE THREAD

PART NUMBER		THREAD			IMENSIC	ONS	
STEEL	BRASS*	N.P.T.	A	В	C	D	E
16E	B16E	3/8-18	1.00	1.15	2.95	1.19	2.39
16	B16	1/2-14	1.00	1.15	3.08	1.19	2.36
16G	B16G	3/4-14	1.13	1.30	3.20	1.19	2.42



#### STANDARD HOSE BARB

PART NUMBER	HOSE		D	IMENSIC	ONS	
STEEL	I.D.	A	В	C	D	E
16-5B	3/8"	1.00	1.15	2.39	1.19	3.36
16-6B 16-7B	1/2" 3/4"	1.00	1.15	2.77	1.19	4.39 4.77



#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE		D	IMENSIC	ONS	
STEEL	I.D.	A	В	С	D	E
16-5BP 16-6BP	3/8" 1/2"	1.00 1.00	1.15 1.15	2.42 2.44	1.19 1.19	3.38 3.53

Steel Grip Ring Sleeves are available for all 10 Series Couplers. See page 34 for details.

FEATURES, SPECIFICATIONS AND AIR FLOW CHARACTERISTICS-PAGES 6 AND 7.

Brass couplers have cadmium plated steel valves, zinc plated steel sleeves, stainless steel balls and springs. To specify brass sleeve and valve, add suffix letter N to model number. Example:

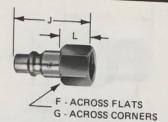


Approximate connected length of coupler and nipple, C + L.

# Industrial interchange sleeve type nipples Nipples on this page will mate with any 10 or 20 Series 1/2" 20 SERIES 1/2" nipples

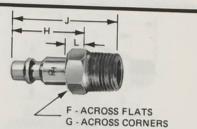
#### FEMALE PIPE THREAD

	UMBER	THREAD		DIMENS	SIONS	······
STEEL	BRASS	N.P.T.	F	G	.1	
H1F H3F H3F-G	внзғ	3/8-18 1/2-14 3/4-14	.81 1.00 1.25	.94 1.15 1.44	2.03 2.25 2.38	.66 .88 1.00



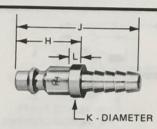
#### MALE PIPE THREAD

PART NUMBER		THREAD			DIMENSI	ONS	
STEEL	BRASS	N.P.T.	F	G	Н	J	
H00F		1/4-18	.69	.79	.91	2.28	.38
H0F		3/8-18	.69	.79	.94	2.31	.38
H2F	BH2F	1/2-14	.88	1.01	1.09	2.47	.38
H2F-G	1	3/4-14	1.13	1.30	1.16	2.53	.38



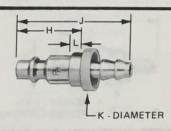
#### STANDARD HOSE BARB

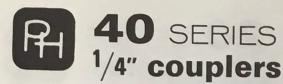
PART NUMBER	HOSE	DIMENSIONS				
STEEL	I.D.	Н	J	K	1	
H4F	3/8"	1.56	2.53	.69	.19	
H5F	1/2"	1.94	3.56	.88	.56	
H5F-G	3/4"	2.03	3.91	1.00	.66	



#### **PUSH-LOK HOSE BARB**

PART NUMBER	HOSE		DIMENS	IONS	
STEEL	I.D.	Н	J	K	L
H4FP	3/8"	1.56	2.52	.86	.19
H5FP	1/2"	1.56	2.66	.97	.19

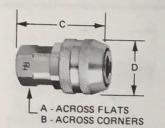




# 40 SERIES Industrial interchange push type couplers

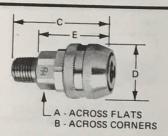
Couplers on this page will mate with any 20 or 40 Series 1/4" nipple regardless of end connection.

Approximate connected length of coupler and nipple, C + L.



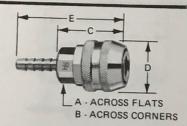
#### **FEMALE PIPE THREAD**

PART NUMBER	THREAD SIZE		DIME	NSIONS	
STEEL	N.P.T.	A	В	C	D
43A	1/8-27	.75	.87	1.83	1.13
43 43E	1/4-18 3/8-18	.75 .81	.87 .94	1.83 1.89	1.13



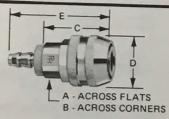
#### MALE PIPE THREAD

PART NUMBER	THREAD SIZE		DI	MENSION	IS	
STEEL	N.P.T.	A	В	C	D	F
42A 42 43E	1/8-27 1/4-18 3/8-18	.75 .75 .75	.80 .80 .80	1.89 2.05 2.08	1.13 1.13 1.13	1.52 1.52 1.52



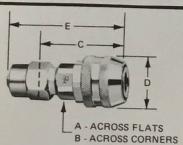
#### STANDARD HOSE BARB

PART NUMBER	HOSE		DI	MENSION	VS.	
STEEL	I.D.	A	В	C	D	F
40-3B 40-4B 40-5B	1/4" 5/16" 3/8"	.75 .75 .75	.80 .80 .80	1.52 1.52 1.52	1.13 1.13 1.13	2.48 2.48 2.48



#### PUSH-LOK HOSE BARB

PART NUMBER STEEL	HOSE		DI	MENSION	IS	
40-3BP	I.D.	A	В	C	D	E
40-5BP	1/4" 3/8"	.75 .75	.80 .80	1.50 1.52	1.13	2.31



#### REUSABLE HOSE FITTINGS

PART NUMBER	TEE:			DI	MENSIONS			
STEEL	I.D.	0.D.	A					
42-C3	1/4		A	В	C	D	E	
42-C4		1/2	.69	.79	1.83	1.13	2.45	
	1/4	17/32	.75	.87	1.83		2.45	
42-C5	1/4	9/16		1000000		1.13		
42-C6				.87	1.83	1.13	2.45	
12 00	1/4	5/8	.81	.94	1.83	1.13	2.45	
42-D5	5/16	9/16	.75					
42-D6				.87	1.83	1.13	2.52	
42-D7	5/16	5/8	.81	.94	1.83	1.13	2.52	
42-D7	5/16	21/32	.88	1.01	1.83	1.13	2.52	
	5/16	11/16	.88	1.01	1.83		2.52	
42-D9	5/16	23/32	.94		100000000000000000000000000000000000000	1.13		
42-D10	1	The second secon		1.08	1.83	1.13	2.52	
12010	5/16	3/4	.94	1.08	1.83	1.13	2.52	

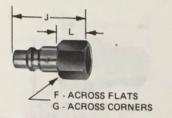
# Industrial interchange nipples for

Nipples on this page will mate with any 20 or 40 Series 1/4" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

#### FEMALE PIPE THREAD

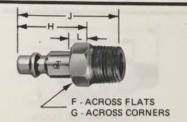
PART	UMBER	THREAD		DIMENS	SIONS	
	BRASS	N.P.T.	F	G	J	L
H1C		1/8-27	.50	.58	1.38	.44
НЗС	внзс	1/4-18	.63	.72	1.50	.56
<b>Н3С-Е</b>		3/8-18	.81	.94	1.59	.66



40 SERIES 1/4" nipples

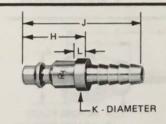
#### MALE PIPE THREAD

PART NUMBER		THREAD		DIM	ENSIONS	iji Is	-
STEEL	BRASS	N.P.T.	F	G	Н	J	L
HOC		1/8-27	.50	.58	.63	1.56	.25
H2C	BH2C	1/4-18	.56	.65	.78	1.72	.25
H2C-E		3/8-18	.69	.79	.88	1.81	.31



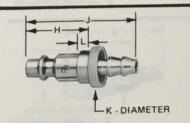
#### STANDARD HOSE BARB

PART NUMBER	HOSE		DIMENS	IONS	
STEEL	I.D.	Н	J	K	L
H8C	1/4"	1.13	2.09	.56	.19
H8C-D	5/16"	1.13	2.09	.56	.19
H9C	3/8"	1.13	2.09	.56	.19



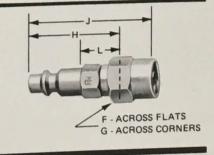
#### **PUSH-LOK HOSE BARB**

PART NUMBER	HOSE		DIMENS	IONS	
STEEL	I.D.	н	J	K	L
H8CP	1/4"	1.13	1.93	.69	.19
H9CP	3/8"	1.13	2.08	.86	.19



#### DELICABLE HOSE FITTINGS

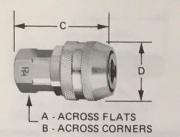
REUSABLE HOSE FITTI										
PART NUMBER	Н	OSE		DII	MENSION	S				
STEEL	I.D.	O.D.	F	G	Н	J	L			
H8C-C3	1/4	1/2	.69	.79	1.56	2.19	.63			
H8C-C4	1/4	17/32	.75	.87	1.56	2.19	.63			
H8C-C5	1/4	9/16	.75	.87	1.56	2.19	.63			
H8C-C6	1/4	5/8	.81	.94	1.56	2.19	.63			
H8C-D5	5/16	9/16	.75	.87	1.56	2.25	.63			
H8C-D6	5/16	5/8	.81	.94	1.56	2.25	.63			
H8C-D7	5/16	21/32	.88	1.01	1.56	2.25	.63			
H8C-D8	5/16	11/16	.88	1.01	1.56	2.25	.63			
H8C-D9	5/16	23/32	.94	1.08	1.56	2.25	.63			
H8C-D10	5/16	3/4	.94	1.08	1.56	2.25	.63			
H8C-E6	3/8	5/8	.88	1.01	1.63	2.56	.69			
H8C-E7	3/8	21/32	.88	1.01	1.63	2.56	.69			
H8C-E8	3/8		.88	1.01	1.63	2.56	.69			
H8C-E9		11/16	100000	1.08	1.63	2.56	.69			
H8C-E10	3/8	23/32	.94	1.08	1.63	2.56	.69			
	3/8	3/4	.94	1.00	1.00					





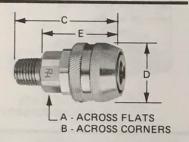
Couplers on this page will mate with any 20 or 40 Series 3/8" nipple regardless of end connection.

Approximate connected length of coupler and nipple, C + L.



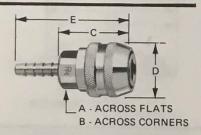
#### FEMALE PIPE THREAD

PART NUMBER	THREAD SIZE		DIMEN	ISIONS	
STEEL	N.P.T.	Α	В	С	D
45C	1/4-18	.88	1.01	2.22	1.19
45	3/8-18	.88	1.01	2.28	1.19
45F	1/2-14	1.00	1.15	2.55	1.19



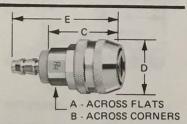
#### MALE PIPE THREAD

PART NUMBER	THREAD SIZE		D	IMENSION	ıs	
STEEL	N.P.T.	A	В	C	D	E
44C	1/4-18	.88	.96	2.36	1.19	1.83
44	3/8-18	.88	.96	2.39	1.19	1.83
44F	1/2-14	.88	.96	2.55	1.19	1.83



#### STANDARD HOSE BARB

PART NUMBER	HOSE		D	MENSION	IS	
STEEL	I.D.	A	В	С	D	E
44-3B	1/4"	.88	.96	1.89	1.19	2.86
44-5B	3/8"	.88	.96	1.86	1.19	2.83
44-6B	1/2"	.88	.96	1.86	1.19	3.86



#### PUSH-LOK HOSE BARB

-		DIMENSIONS					
.D.	A	В	C	D	E		
3/8"	.88	.96 .96	1.91 1.92	1.19 1.19	2.72 2.88 2.98		
		.88 .88" .88	.88 .96 .88 .96	8/4"     .88     .96     1.91       8/8"     .88     .96     1.92	8/4"     .88     .96     1.91     1.19       8/8"     .88     .96     1.92     1.19		

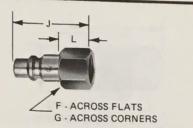
# Industrial interchange nipples for

Nipples on this page will mate with any 20 or 40 Series 3/8" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

#### **FEMALE PIPE THREAD**

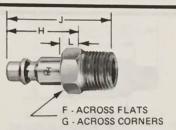
PART N	IUMBER	THREAD SIZE		DIMENS	SIONS	TOUR
STEEL	BRASS	N.P.T.	F	G	J	L
H01E		1/8-27	.63	.72	1.38	.34
H1E		1/4-18	.63	.72	1.59	.56
Н3Е	BH3E	3/8-18	.81	.94	1.69	.66
H3E-F		1/2-14	1.00	1.15	1.84	.81



40 SERIES
3/8" nipples

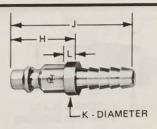
#### MALE PIPE THREAD

PART N	IUMBER	THREAD SIZE	DIMENSIONS					
STEEL	BRASS	N.P.T.	F	G	Н	J	L	
H00E		1/8-27	.63	.69	.69	1.72	.31	
H0E	13. 148.	1/4-18	.63	.72	.84	1.88	.31	
H2E	BH2E	3/8-18	.69	.79	.88	1.91	.31	
H2E-F		1/2-14	.88	1.01	1.09	2.13	.38	



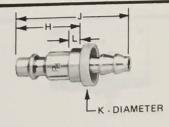
#### STANDARD HOSE BARB

PART NUMBER	HOSE		DIMENS	IONS	
STEEL	I.D.	Н	J	K	L
H4E	1/4"	1.22	2.19	.63	.19
H5E	5/16"	1.22	2.19	.63	.19
H6E	3/8"	1.59	3.22	.88	.56



#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE		DIMENSIONS			
STEEL	I.D.	н	J	K	L	
H4EP	1/4"	1.22	2.02	.69	.19	
H5EP	3/8"	1.22	2.17	.86	.19	
H6EP	1/2"	1.22	2.31	.97	.19	

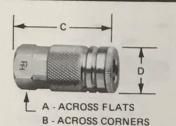




# 50 SERIES Aro 210 interchange 1/4" couplers Occupiers Occupiers Occupiers Occupiers Occupiers of end contribution of this page will nipple regardless of end contribution of the couplers of end contribution of the couplers of the couplers

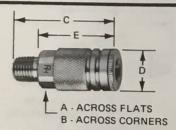
Couplers on this page will mate with any 50 Series 1/4" nipple regardless of end connection.

Approximate connected length of coupler and nipple, C+L.



#### FEMALE PIPE THREAD

PART NUMBER	THREAD SIZE		DIME	NSIONS	
STEEL	N.P.T.	Α	В	С	D
53A	1/8-27	.75	.87	1.86	.88
53	1/4-18	.75	.87	1.86	.88
53E	3/8-18	.81	.94	1.92	.88



#### MALE PIPE THREAD

PART NUMBER	THREAD			DIMENSIC	ONS	
STEEL	N.P.T.	Α	В	C	D	E
52 52E	1/4-18 3/8-18	.75 .75	.80	2.08	.88	1.55 1.55



#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE		1	DIMENSIC	ONS	
STEEL	I.D.	A	В	C	D	E
50-3BP 50-5BP	1/4" 3/8"	.75 .75	.80	1.53 1.55	.88	2.34 2.50

Nipples on this page will mate with any 50 Series 1/4" coupler regardless of end connection,

Approximate connected length of coupler and nipple, C+L.

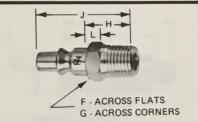
#### FEMALE PIPE THREAD

PART NUMBER STEEL	THREAD		DIME	NSIONS	
	N.P.T.	F	G	J	L
A1C	1/8-27	.50	.58	1.28	.44
A3C	1/4-18	.63	.72	1.41	.56
A3C-E	3/8-18	.81	.94	1.50	.66

# F - ACROSS FLATS **G-ACROSS CORNERS**

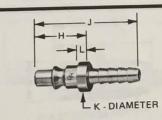
#### MALE PIPE THREAD

PART NUMBER	THREAD		D	IMENSIO	NS	-
STEEL	N.P.T.	F	G	Н	J	L
A0C A2C A2C-E	1/8-27 1/4-18 3/8-18	.50 .56 .69	.58 .65 .79	.63 .78 .88	1.47 1.63 1.72	.25 .25 .31



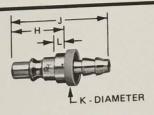
#### STANDARD HOSE BARB

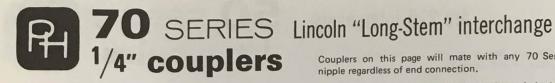
PART NUMBER	HOSE		DIMENSIONS				
STEEL	I.D.	Н	J	K	L		
A8C	1/4"	1.03	2.00	.56	.19		
A8C-D	5/16"	1.03	2.00	.56	.19		
A9C	3/8"	1.03	2.00	.56	1.19		



### **PUSH-LOK HOSE BARB**

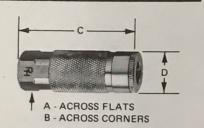
PART NUMBER	HOSE		DIME	NSIONS	
STEEL	I.D.	Н	J	K	L 10
A8CP	1/4	1.03	1.83	.59	.19
A9CP	3/8	1.03	1.98	.86	.19



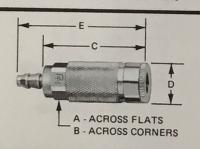


Couplers on this page will mate with any 70 Series 1/4"

Approximate connected length of coupler and nipple, C + L.



-			1
型 型		-	D
	2000		_ *



#### **FEMALE PIPE THREAD**

PART NUMBER	THREAD SIZE	DIMENSIONS						
STEEL	N.P.T.	A	В	C	D			
73A	1/8-27	.75	.87	2.39	.88			
73	1/4-18	.75	.87	2.39	.88			
73E	3/8-18	.81	.94	2.45	.88			

#### MALE PIPE THREAD

PART NUMBER	THREAD			DIMENSI	ONS	
STEEL	N.P.T.	A	В	C	D	E
72A	1/8-27	.75	.80	2.44	.88	2.06
72	1/4-18	.75	.80	2.59	.88	2.06
72E	3/8-18	.75	.80	2.63	.88	2.06

#### PUSH-LOK HOSE BARB

PART NUMBER	HOSE		1	DIMENSI	ONS	
STEEL	I.D.	A	В	C	D	E
70-3BP	1/4"	.75	.80	2.06	.88	2.88

# Lincoln "Long-Stem" interchange TO SERIES this page will mate with any 70 Series 1/4" 1/4" nipples

Nipples on this page will mate with any 70 Series 1/4" coupler regardless of end connection.

Approximate connected length of coupler and nipple, C + L.

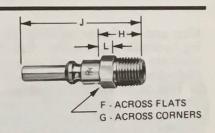
#### **FEMALE PIPE THREAD**

PART NUMBER	THREAD SIZE	DIMENSIONS						
STEEL	N.P.T.	F	G	J	L			
L3C	1/4-18	.63	.69	2.03	.50			

# F - ACROSS FLATS G - ACROSS CORNERS

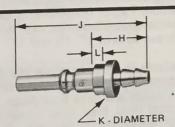
#### MALE PIPE THREAD

PART NUMBER	THREAD		DIMENSIONS							
STEEL	N.P.T.	F	G	Н	J	L				
L2C	1/4-18	.56	.61	.78	2.25	.25				



#### **PUSH-LOK HOSE BARB**

PART NUMBER	HOSE		DIMEN	ISIONS	
STEEL	I.D.	Н	J	K	L
L8CP	1/4"	1.66	2.46	.69	.19
L9CP	3/8"	1.66	2.61	.86	1 .19



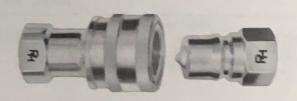
# Darker DOUBLE SHUT-OFF QUICK COUPLINGS

FEATURES, SPECIFICATIONS, FLOW CHARACTERISTICS

## 60 SERIES Industrial interchange sleeve type

Most popular Parker coupling for today's demanding hydraulic applications. Especially designed to minimize maintenance and downtime, Parker Series 60 hydraulic couplings are available in a wide range of sizes to fit most applications. There is a separate body size for each of the six pipe sizes from 1/8" to 1", all of which are interchangeable with industrial interchange couplers of other makes. In addition, Parker offers one larger body size, with interchangeable bushings, to provide three additional thread sizes of 1", 1% and 1%".

Available in steel, brass, or stainless, Parker Series 60 hydraulic couplings feature streamlined poppettype valves and large flow paths, resulting in lower pressure drop than most competitors. Valves are fully replaceable in the field. Brass couplers have two 0-ring seals for superior sealing in the most severe applications and stainless steel locking balls and springs for maximum corrosion resistance. Steel and stainless steel couplers in sizes 1 through 8 utilize a teflon backup ring to protect the 0-ring from extrusion and damage. This also allows higher working pressures than most competitors. Temperature range with standard Buna-N seal is -400 to +250° F. See page 5 for optional seal materials and temperature ranges.





# 4600 SERIES

Interchangeable with Bruning SM Series couplings. the new Parker 4600 Series couplings offer minimum pressure drop, positive shutoff, and reliable sealing at minimum cost for all conventional hydraulic applications. The valve is of poppet-type construction and can be replaced in the field. A unique "T" seal assures long, trouble-free performance. Standard seal material is Buna-N, for operating temperatures of 400 to +2500 F. Optional seal materials and temperature ranges are listed on page 5.



# CONNECT AND DISCONNECT UNDER PRESSURE

# 5000 SERIES

Series 5000 is an economical coupling designed to couple and uncouple under trapped pressure without remote valving. The threaded, poppet-type valve portion of the coupler is simply backed-off using conventional wrenches until disconnection is possible. Standard seal material for Series 5000 couplings is Buna-N. Operating temperatures are -400 to +2500 F. Optional seal materials and temperature ranges are listed on page 5.



# 3000 SERIES

Parker Series 3000 couplings are designed for the high pressures encountered with hydraulic jacks, rams, and similar equipment. Constructed of heavy duty zinc plated steel, with precision ball-type valve for reliable long-life service. Coupling is accomplished by threading body and nipple together by hand. Patented Parker "Q-Ring" polyurethane seal is standard for operating temperatures of -650 to +2000 F.



#### FLOW DATA AND PRESSURE RATINGS

0		FLO	ow (G	i.P.M.)	Vs PF	RESSU	Р	MAXIMUM OPERATING PRESSURE (PSIG)					
SERIES	BODY SIZE				-H-560						STEEL	STAINLESS	BRASS
	1/8	G.P.M. △P	0.5	1.0	1.5 7.4	2.0 12.8	2.5 18.5	3.0 25.1	3.5 32.8	4.0* 42.8	5,000		1,000
	1/4	G.P.M. △P	1.0	2.0	3.0 7.2	4.0	4.5 14.9	5.0 17.9	5.5 22.5	6.0* 25.8	5,000	2,000	1,000
	3/8	G.P.M. △P	2.0	4.0	6.0 6.6	8.0 11.5	8.5 12.8	9.0 14.0	9.5 15.5	10.0* 16.6	4,000	1,500	1,000
60	1/2	G.P.M. △P	2.5	5.0 2.5	10.0	12.0 11.6	14.0 15.3	16.0 18.8	18.0 23.8	20.0*	4,000	1,500	1,000
	3/4	G.P.M.	5.0	10.0	15.0 3.4	20.0 5.2	<b>25.0</b> 9.1	30.0 12.6	32.5 14.4	<b>35.0*</b> 16.8	2,500	1,500	1.000
	1	G.P.M. △P	7.5	10.0	20.0	30.0 6.8	35.0 8.6	40.0	45.0 13.8	50.0* 17.0	2,000	1,000	1,000
	1 1/2		20.0	30.0	40.0 1.68	50.0 2.57		100.0 10.23	125.0* 16.05	150.0** 22.75	1,000		800
2000	1/4	G.P.M. △P	1.0	2.0	3.0 20.6	4.0 35.1	4.5 43.7	5.0 52.9	5.5 64.2	6.0* 72.6	10.000 (Static)		
3000	3/8	G.P.M. △P	2.0	4.0 13.9	6.0 28.8	8.0 52.9	8.5 60.0	9.0 65.3	9.5 74.5	10.0* 78.9	10.000 (Static)		
4600	1/4	G.P.M. △P			co	NSULT	FACT	ORY			CON	SULT FACTO	RY
4000	1/2	G.P.M. △P	2.5	5.0 3.0	10.0 9.8	12.0 13.2	14.0 17.7	22.5	18.0 26.1	20.0* 32.1	2,000		
5000	1/2	G.P.M. △P	2.5	5.0 4.5	10.0	12.0 19.5	14.0 25.0		18.0 35.4	20.0* 47.3	2,200		

<sup>\*</sup>Approximate 20 feet per second in schedule 40 pipe of nominal size,

\*\*Media for size 12 test was Stoddard solvent at 70°F.

Design details and specifications are subject to change without notice.

# Industrial interchange hydraulic couplers

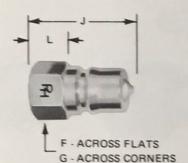
Approximate connected length of coupler and nipple, C + L.



- ACROSS FLATS **B-ACROSS CORNERS** 

# coupler

BODY	P/	ART NUME	BER	SIZE		IMENS	IONS	
SIZE	STEEL	BRASS	STAINLESS	N.P.T.	A	В	C	D
1/8"	H1-62	BH1-60		1/8-27	.63	.69	1.97	.94
1/4"	H2-62	BH2-60	* SSH2-62	1/4-18	.75	.88	2.44	1.13
3/8"	H3-62	BH3-60	* SSH3-62	3/8-18	.88	1.00	2.75	1.38
1/2"	H4-62	BH4-60	SSH4-62	1/2-14	1.13	1.31	2.94	1.75
3/4"	H6-62	BH6-60	SSH6-62	3/4-14	1.31	1.56	3.48	2.13
1"		BH8-60	SSH8-62	1-11½	1.63	1.88	4.13	2.50



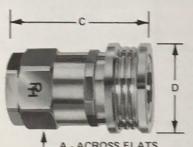
# nipple

BODY	P/	ART NUMB	ER	THREAD		DIMEN	ISIONS	
SIZE	STEEL	BRASS	STAINLESS	N.P.T.	F	G	J	L
1/8"	H1-63	BH1-61		1/8-27	.63	.72	1.53	.69
1/4"	H2-63	BH2-61	* SSH2-63	1/4-18	.69	.79	1.72	.69
3/8"	H3-63	BH3-61	* SSH3-63	3/8-18	.88	1.01	1.95	.77
1/2"	H4-63	BH4-61	SSH4-63	1/2-14	1.13	1.30	2.05	.69
3/4"	H6-63	BH6-61	SSH6-63	3/4-14	1.38	1.59	2.36	.67
1"	H8-63	BH8-61	SSH8-63	1-11½	1.63	1.88	2.86	.94

LARGER SIZES

One larger body size, with interchangeable bushings, provides three additional thread sizes of 1",  $1\frac{1}{4}$ ", and  $1\frac{1}{2}$ ".

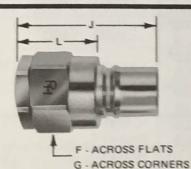
NOTE: Valve perch fabricated from 302 stainless steel.



- ACROSS FLATS **B** - ACROSS CORNERS

## coupler

BODY	PART N	UMBER	THREAD SIZE	DIMENSIONS				
SIZE	STEEL	BRASS	N.P.T.	A	В	C	D	
11/2"		BH12-60J		2.63	2.94	4.81	3.25	
1½"	H12-62L	BH12-60L	1%-11%	2.63	2.94	4.81	3.25	
1%"	H12-62N	BH12-60N	1%-11%	2.63	2.94	4.81	3.25	



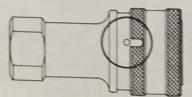
# nipple

BODY	PART N	UMBER	THREAD SIZE	DIMENSIONS					
SIZE	STEEL	BRASS	N.P.T.	F	G	J	L		
1½" 1½" 1½"	H12-63L	BH12-61J BH12-61L BH12-61N	1%-11%	2.63 2.63 2.63	2.94 2.94 2.94	4.77 4.77 4.77	2.66 2.66 2.66		

#### **DUST PLUGS & DUST CAPS** for couplers and nipples protect hydraulic systems from damaging grit.



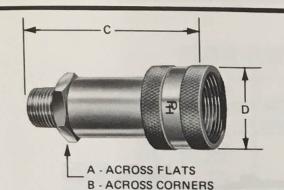
BODY	DUST	DUST
1	H1-65	H1-66
2	H2-65	H2-66
3	H3-65	H3-66
4	H4-65	H4-66
6	H6-65	H6-66
8	H8-65	H8-66
12	H12-65	H12-68

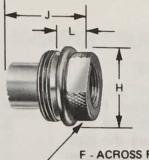


All sizes can be furnished with "Locking Sleeves" as illustrated at left. Place suffix letters SL (Sleeve-Lok) after regular catalog number Example: H3-625L

# Industrial interchange hydraulic couplers



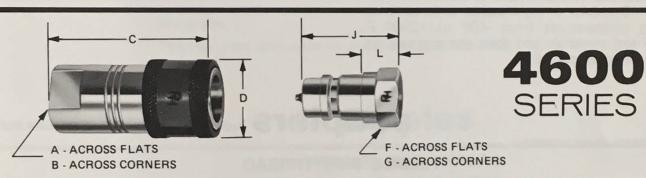




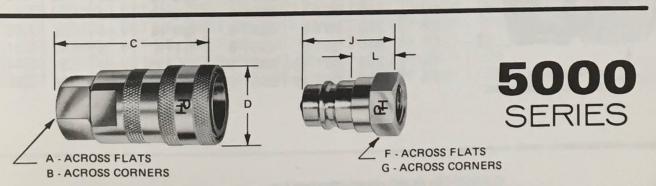
3000 SERIES

F - ACROSS FLATS G - DIAMETER

BODY	THREAD	PART NU	MBER	DIMENSIONS								
SIZE	SIZE	COUPLER	NIPPLE	A	В	C	D	F	G	Н	J	L
1/4 3/8	1/4 3/8	3050-2 3050-3	3010-2 3010-3	.81 1.00	.94 1.15	2.38 2.88	1.13 1.38	.75 .94	.94 1.13	1.13 1.94	1.25 1.50	.50



BODY	THREAD	PART N	UMBER	DIMENSIONS							
SIZE	N.P.T.	COUPLER	NIPPLE	A	В	С	D	F	G	J	L
1/4	1/4	4650-2	4610-2	.82	.94	2.20	1.06	.75	.87	1.50	.75
1/4	3/8	4650-2-3	4610-2-3	.82	.94	2.20	1.06	.88	1.01	1.50	.75
1/2	1/2	4650-4	4610-4	1.13	1.38	3.13	1.56	1.06	1 1.23	1.94	1 .74



BODY	THREAD	PART NUMBER		DIMENSIONS								
SIZE	N.P.T.	COUPLER	NIPPLE	A	В	C	D	F	G	J	L	
1/2	1/2	5050-4 5050-5	5010-4 5010-5	1.06	1.23	2.88	1.50 1.50	1.06 1.25	1.23	1.81	.81	

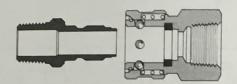
Dust plugs and caps keep dirt out of your equipment when coupler halves are disconnected. Both rubber and metal caps and plugs are available. Consult price list for specific part number.



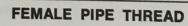
#### PARKER STRAIT-THRU COUPLINGS

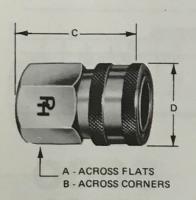
Available in steel, brass, or stainless steel, Parker Series ST couplings offer the lowest pressure drop of any quick coupling design. They are the ideal coupling where maximum flow is required and can be used with a variety of fluids. Since there is no valving in either coupler or nipple, fluid flow should be stopped before disconnecting coupling. An exacting 0-ring seal assures a leakproof connection.

Series ST Couplings are available in male and female pipe thread end configurations in sizes from 1/8" to 11/2". Standard 0-ring material is Buna-N for operating temperatures from -400 to +2500 F. Optional seal materials and their temperature rattings are listed on page 5.



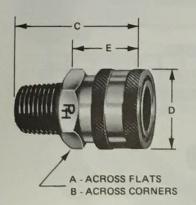
# Couplers Approximate connected length of coupler and nipple, C+L.





BODY		PART	NUMBER	THREAD	DIMENSIONS				
SIZE	BORE	BRASS	STAINLESS	N.P.T.	A	В	C	D	
1/8"	.172	BST-1	SSST-1	1/8-27	.56	.65	1.06	.69	
3/8"	.250	BST-2	SSST-2	1/4-18	.81	.94	1.50	.94	
1/2"	.406	BST-3	SSST-3	3/8-18	1.00	1.15	1.59	1.13	
3/4"	.500	BST-4	SSST-4	1/2-14	1.13	1.30	1.91	1.31	
1"	.750	BST-6	SSST-6 *	3/4-14	1.44	1.66	2.05	1.63	
1%"	.969	BST-8	SSST-8	1-111/2	1.75	2.02	2.31	2.00	
11/2	1.250	BST-10	SSST-10	14-11/2	2.00	2.31	2.44	2.50	
1 /2	1.500	BST-12	SSST-12	1%-11%	2.56	2.96	2.88	3.13	

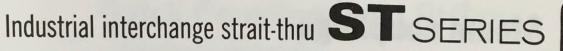
Stainless steel only - A = 1.50 B = 1.73



#### MALE PIPE THREAD

BODY SIZE	BORE	PART BRASS	NUMBER STAINLESS	THREAD		DIME	NSIO	NS	
1/8"	.172	BST-1M	STAINLESS	THE RESERVE AND ADDRESS OF THE PERSON NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS NOT THE PERSON NAMED IN COLUMN TWO IS NAMED IN COLUMN TWO IS N	A	В	C	D	E
1/4"		BST-2M		1/8-27	.56	.65	1.06	.69	.69
3/8"		BST-3M		1/4-18	.81	.94	1.69	.94	1.16
1/2"		BST-4M	SSST-3M SSST-4M	3/8-18	1.00	1.15	1.75	1.13	1.19
3/4"		BST-6M	CCCT COA	1/2-14	1.13	1.30	2.00	1.31	1.28
1"	.969	BST-RM	SSST-6M * SSST-8M		1.44	1.66	2.23	1.63	1.45
		1410-1-0141	9921-8W	1-11%	1.75	2.02	2.53	2.00	1.59

Stainless steel only - A = 1.50 B = 1.73





### FLOW DATA AND PRESSURE RATINGS

	FLOW	FLOW	DATA	MAXIN	NUM (PSIG)
BODY	PASSAGE	PRESSURE	TEST FLOW	OPERATI	NG PRESSURE
SIZE	DIAM.	DROP (PSIG*)	(GPM)	BRASS	STAINLESS
1/8	.172	11.6	4.0	1,000	1,500
1/4	.250	5.7	6.0	1,200	1,200
3/8	.375	1.8	10.0	800	800
1/2	.469	3.2	20.0	500	600
3/4	.719	1.3	35.0	500	600
1	.969	0.8	50.0	300	300
1 1/4	1.187	0.8	76.5	300	300
1 1/2	1.437	2.5	125.0	300	300

<sup>\*</sup> Test Media-H-5606 oil at 1000, approximately 20 feet per second velocity, Sch. 40 pipe.

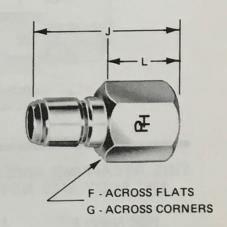
Design details and specifications are subject to change without notice.

Approximate connected length of coupler and nipple, C + L.

# nipples

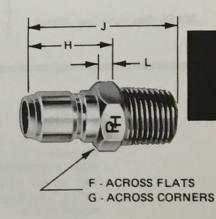
#### **FEMALE PIPE THREAD**

BODY	BORE	PART NUMBER			THREAD SIZE		IMENS	IONS	
SIZE		STEEL	BRASS	STAINLESS	N.P.T.	F	G	J	L
1/8"	.172	ST-N1	BST-N1	SSST-N1	1/8-27	.56	.65	1.00	.56
1/4"	.250	ST-N2	BST-N2	SSST-N2	1/4-18	.69	.79	1.50	.70
3/8"	.375	ST-N3	BST-N3	SSST-N3	3/8-18	.81	.94	1.63	.75
1/2"	.469	ST-N4	BST-N4	SSST-N4	1/2-14	1.00	1.15	1.94	.97
3/4"	.719	ST-N6	BST-N6	SSST-N6	3/4-14	1.19	1.37	2.06	.94
1"	.969	ST-N8	BST-N8	SSST-N8	1-111/2	1.63	1.88	2.25	1.03
11/4"	1.188	ST-N10		SSST-N10	11/4-11/2	2.44	2.00	2.31	1.09
1½"	1.437	31-1010		SSST-N12	1½-11½	2.25	2.60	2.94	1.22



### MALE PIPE THREAD

BODY	BORE	RE PART NUMBER			THRD	DIMENSIONS				
SIZE		STEEL		STAINLESS	N.P.T.	F	G	Н	J	L
1/8"	.172	ST-N1M	BST-N1M	SSST-N1M	1/8-27	.44	.51	.63	1.06	
1/4"	.250	ST-N2M	BST-N2M	SSST-N2M	1/4-18	.56	.65	.78	1.58	.25
3/8"	.375	ST-N3M	BST-N3M	SSST-N3M	3/8-18	.69	.79	.81	1.69	.25
1/2"	.469	ST-N4M	BST-N4M	SSST-N4M	1/2-14	.88	1.01	1.03	2.00	
3/4"	.719	ST-N6M	BST-N6M	SSST-N6M	3/4-14	1.06	1.23	1.16	2.28	.38
1"	.969	ST-N8M	BST-N8M	SSST-N8M	1-111/2	1.38	1.59	1.31	2.53	.38

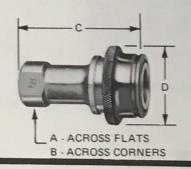




# **Steam couplings**

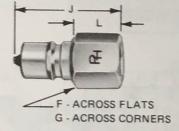
Special couplings for steam installations such as tire recapping equipment, rubber molds, steam cleaners, vulcanizers, sterilizers, etc. Coupling features a brass body and nipple with stainless locking balls and springs. A double 0-ring seal is provided for extra sealing power. Large steel grip-ring allows ease of operation with gloved hands as well as high impact resistance.

Working pressure: up to 100 PSI gage saturated steam (3380 F).



## coupler

	PART NUMBER	THREAD		DIMENSIONS					
SIZE	BRASS	N.P.T.	A	В	С	D			
3/8"	H3-68	3/8-18	.88	1.00	2.75	1.75			



## nipple

	PART NUMBER	THREAD SIZE	DIMENSIONS						
SIZE	BRASS	N.P.T.	F	G	J	L			
3/8"	H3-69	3/8-18	.88	1.01	1.95	.77			

NOTE: For other sizes refer to Series 60 Brass Couplings on page 30 and specify EPR seals (Code W).

#### TIRE RECAPPING ACCESSORIES 1/4" BODY SIZE NIPPLES

For use on inflation bags in tire recapping facilities are of Series 20 design for industrial interchange. Nipples will mate with any 20 or 40 Series 1/4" coupler listed on pages 14

**H6C NIPPLE** 



.302-32 (Tire Valve Cap) Thread

**H7C NIPPLE** 



.482-26 (Tire Valve Stem) Thread

**H4C NIPPLE** 



1/4" NPS Thread

**H5C NIPPLE** 



1/4" NPT External by .302-32 Internal Threads.

#### STEEL GRIP-RING SLEEVE

This Grip-Ring sleeve enables the operator to connect or disconnect the Coupling instantly, even with greasy hands or while wearing heavy gloves. Steel Grip-Ring sleeves are available for all 10 and 20 Series Couplers. To specify a model with a Grip-Ring sleeve, add the suffix letter R to the regular model number.



# **Quick Coupling hose fittings**

-for air hose maintenance





#### MALE HOSE BARB



#### MALE REUSABLE HOSE END

PART NU	IMBER	HOSE	THREAD
STEEL	BRASS	ID	SIZE
308C	308	1/4	1/8
310C	310	1/4	1/4
	318 1/4	1/4	3/8
310D	310 5/16	5/16	1/4
310E	310 3/8	3/8	1/4
318E	318	3/8	3/8
322F-E	-	3/8	1/2
	310 1/2	1/2	1/4
318E-F	-	1/2	3/8
322F		1/2	1/2
322F-G	-	3/4	1/2

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#### FEMALE HOSE BARB

PART NUMBER STEEL	HOSE ID	THREAD
311C	1/4	1/4
311E	3/8	1/4



# **BRASS SWIVEL**

PART NUMBER BRASS	HOSE ID	THREAD
317	1/4	1/4
317 5/16	5/16	1/4
317 3/8	3/8	1/4



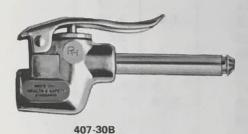
#### BRASS SPLICER

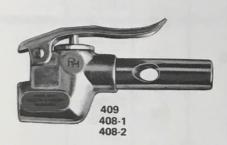
PART NUMBER BRASS	HOSE	DIAMETER
314	1/4	3/8
314 5/16	5/16	7/16
314 3/8	3/8	9/16

		11001	LIND
PART NUMBER	HOSE	SIZE	THREAD SIZE
	ID	OD	N.P.T.
330-C3 330-C4 330-C5 330-C6 332-D5	1/4	1/2 17/32 9/16 5/8 9/16	
332-D3 332-D6 332-D7 332-D8 332-D9 332-D10	5/16	5/8 21/32 11/16 23/32 3/4	1/4
332-E6 332-E7 332-E8 332-E9 332-E10	3/8	5/8 21/32 11/16 23/32 3/4	
334-C3 334-C4 334-C5 334-C6	1/4	1/2 17/32 9/16 5/8	
334-D5 334-D6 334-D7 334-D8 334-D9 334-D10	5/16	9/16 5/8 21/32 11/16 23/32 3/4	3/8
334-E6 334-E7 334-E8 334-E9 334-E10	3/8	5/8 21/32 11/16 23/32 3/4	

# Blow guns-controlled and full flow













Section 1910.242 paragraph (b) of Occupational Safety and Health Standards, Department of Labor Rules and Regulations, makes the following requirement:

(b) Compressed air used for cleaning. Compressed air shall not be used for cleaning purposes except where reduced to less than 30 p.s.i. and then only with effective chip guarding and personal protective equipment.

This requirement, plus additional limits on noise level, are met by Parker Controlled-Flow blow guns which have tamper-proof pressure reducers built into the valves to limit air pressure at the nozzle. Their performance in accordance with the above regulation 1910.242 has been verified by an independent testing laboratory. Nozzle exhaust ports prevent pressure build-up if nozzle tip is blocked. Blow guns have a maximum nozzle pressure of 23 psi with line pressure at 80 psig, at 100 psig line pressure maximum nozzle pressure is less than 30 psig.

Your Parker distributor has them in stock.

# CONTROLLED FLOW GUNS - ALL MODELS MEET OSHA REQUIREMENTS

#### **406-30B BUTTON VALVE GUN**

Aluminum alloy body molded to fit the hand. Handy built-in hangup hook and leak proof valve. Tapped 1/4" NPT female thread inlet.

#### **407-30B THUMB LEVER GUN**

Extended nozzle aluminum alloy body with 1/4" NPT female inlet thread. Thumb lever aids in controlling air flow.

#### **VENTURI NOZZLE GUNS**

Recommended for use where low pressure with high volume is required.

#### **409 SAFETY GUN**

Thumb lever type with venturi nozzle. Aluminum alloy body with tapped 1/4" NPT female thread inlet. Meets OSHA requirements.

### 408-1, 408-2 CONTROLLED FLOW SAFETY GUN

Same as 409 but with built in pressure control. Meets OSHA requirements.

#### SPECIFICATIONS FOR OSHA APPROVED GUNS

CATALOG	INITIAL	NOZZEL PR	RESSURE	AIR	
NUMBER	(PSIG)	DYNAMIC	STATIC	(SCFM)	SOUND LEVEL DYNAMIC
406-30B	100	22.2	23.3		
407-30B	100	24.4		7.0	74.5
408-1	100	24,4	24.1	7,6	73
408-2	100	2.4	1,0	7,0	80.5
409	100		2.5	12.0	87.3
400	100	94.2	3.7	28.3	96.7

#### **FULL FLOW GUNS**

#### **400 BUTTON VALVE GUN**

Full flow gun without internal pressure control. Aluminum alloy body with 1/4" NPT female inlet thread.

#### **401 THUMB LEVER GUN**

Aluminum alloy body without internal pressure control. Thumb lever aids in controlling air flow - has hole for hanging. 1/4" NPT female inlet thread.

#### **401V THUMB LEVER GUN**

Two-way air flow valve for use on air, liquid lines. Dependable thumblever operation. Aluminum alloy body with 1/4" NPT female inlet threads.

#### **401VA THUMB LEVER GUN**

Same as 401V but with 1/4" NPT inlet and 1/8" NPT outlet.

# AIR FILTER, AIR FUSE

#### PARKER 150 AIR LINE FILTER

The Parker 150 Air Line Filter is an extremely effective accessory that protects air operated shop tools and equipment from rust, pipe scale. dirt. etc. Reduces down time, prevents expensive repairs and prolongs tool life. The remarkable Microbon filter element (resin-impregnated cellulose) withstands full working pressure without collapsing and is easily replaced. Or it can be cleaned simply by reversing flow (back flushing). Available with 1/4" female N.P.T. inlet and 1/4" male N.P.T. outlet.

#### \*FLOW DATA-MIL-H-5606 @ 100º F.

GPM	.15	.25	50	.75	1.0	2.0	3,0	4.0	4,5	5.0
PRESSURE DROP - PSI		.8	2.5	3.5	6.0	15.1	28.9	47.9	59.0	79.5

#### \*FLOW DATA - AIR

PRESSURE DROP-PSI	2.	4.	6.	8.	10.	12.	14.	16.	18.	20.
SCFM 80 PSI	7.9	11.6	13.9	16.1	17.8	19.5	20.0	21.5	22.4	23.4
SCFM 100 PSI	9.2	13.3	16.0	18.2	20.2					

<sup>\*</sup> Average values with new, clean filtering element.



#### FILTRATION-

40 Micron (.0016") nominal. Effective area: 1 Sq. In.

#### PRESSURE RATING-

Working Pressure: 1000 psi Proof Pressure: 2000 psi Burst Pressure: 5000 psi

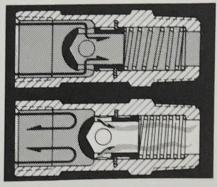
#### PARKER 170 AIR FUSE

Designed and built for heavy duty air operated tools, the Parker 170 Air Fuse automatically closes to prevent violent hose-whip when a hose breaks, a fitting fails, or an air tool is disconnected. Meets Federal safety requirements. Brass body. Stainless steel spring and retainer with nylon poppet.

#### **HOW IT WORKS**

- 1. Air Fuse is normally open. The nylon poppet is held in the open position by a spring.
- 2. Automatic closure When a line break causes air flow to suddenly increase beyond a critical rate (see Flow Data Chart below), the surge of air drives the poppet to its closed position.
- 3. Automatic reset When the break is repaired and pressures equalize, the spring returns the poppet to its normal position.





#### **Technical & Dimensional Data**

#### Cut off flow data (approx.)

PART NO.					MAX. WORKING PRESSURE		30 PSI	APP 60 PSI	ROXII 70 PSI	80 PSI	90 PSI	FF FLO 100 PSI	W (SC 110 PSI	FM) 120 PSI	150 PSI
170-6	%" Male & Female NPT	1-14"	2.98	125 SCFM	250 PSI	9.15	78	105	113	118	125	133	148	155	175
170-8	1" Male & Female NPT	1-1/2"	3.09	200 SCFM	250 PSI	12.50	125	166	178	188	200	210	216	222	239

# Parker QUICK COUPLINGS



#### WAREHOUSE LOCATIONS

#### CALIFORNIA

888-92nd Avenue Oakland, California 94603 Phone: (415) 632-0238 Telex: 33-6428

1725 Gage Road Montebello, California 90640 Phone: (213) 685-9510 Telex: 67-4415

#### **GEORGIA**

1735 Tully Circle N. E. Atlanta, Georgia 30329 Phone: (404) 633-0263 Telex: 54-2929

#### **NEW JERSEY**

28 Springdale Road Cherry Hill, New Jersey 08003 Phone: (609) 424-3200 Telex: 83-4386

#### OHIO

1701 Arabello Road Cleveland , Ohio 44112 Phone: (216) 531-3000 Ext 511

10683 McKinley Road Cincinnati, Ohio 45242

Phone: (513) 984-1455 Telex: 21-4197

#### **TEXAS**

2837 Satsuma Street
Dallas, Texas 75229
Phone: (214) 241-7621 Telex: 73-2495

#### CANADA

Box 158, Durham Road Grimsby, Ontario, Canada Phone: (416) 945-2274 Telex: 021-695

## REGIONAL SALES OFFICES

#### **PACIFIC REGION**

888 92nd Avenue Oakland, California 94603 Telephone 415-632-0238 Telex: 33-6428

#### **SOUTHEAST REGION**

1735 Tully Circle N. E. Atlanta, Ga. 30329 Telephone 404-633-0263 Telex: 54-2929

#### **NORTHEAST REGION**

280 Midland Ave. Saddle Brook, N. J. 07662 Telephone 201-791-2400 Telex: 13-4424

#### **CLEVELAND REGION**

17325 Euclid Avenue Cleveland, Ohio 44112 Telephone 216-531-3000 Telex: 98-0636

#### **DETROIT/CHICAGO REGION**

900 Plymouth Road Plymouth, Mi. 48170 Telephone 313-453-8828 Telex: 23-5383

#### MIDWEST REGION

8880 Wentworth Ave, So. Bloomington, Mn. 55420 Telephone 612-884-7207 Telex: 29-0189

#### **SOUTHWEST REGION**

2837 Satsuma
Dallas, Tx. 75229
Telephone 214-241-7621 Telex: 73-2495

#### CANADA

Parker Hannifin (Canada) Ltd. 2362 Fairview, Burlington, Ontario, Canada Telephone 416-634-5516 Telex: 02-1762

#### SUBSIDIARIES AND JOINT VENTURES

#### ARGENTINA

Parker Hannifin Argentina S.A.I.C.

#### AUSTRALIA

Parker Hannifin (Australia) Pty. Ltd.

#### RRA7II

Parker Seal Do Brasil, Ind. e Com. Ltda.

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#### THE NETHERLANDS

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#### **SCANDINAVIA**

#### DENMARK

Stig Eklund, A/S

#### **FINLAND**

Oy Stig Eklund AB

#### SWEDEN

Stig Eklund AB

#### SPAIN

Parker Hannifin S. A.,

#### REPUBLIC OF SOUTH AFRICA

Parker Hannifin (Africa) Pty. Ltd.,

#### **UNITED KINGDOM**

Parker Hannifin (UK) Ltd.

QUICK COUPLING DIVISION

PARKER HANNIFIN

P. O. Box 1359, Minneapolis, Minnesota 55440 Telephone 612-544-7781 Telex 29-0320 Bluet Cald Fance

### Stanley Auto-Slide<sup>®</sup> Entrances

New all-weather pneumatic and Magic-Slide® electric.



# Welcome business in all ways-in all ways-in all weather-with Auto-Slide entrances.

Whatever your business is, give it a new dimension with a famous Stanley Auto-Slide entrance. Within the 6000 series or 5000 series you'll find just what you need for a prestige look. For customer convenience and service. For savings on heating and air-conditioning costs. And for finding valuable selling space previously lost to swinging doors.

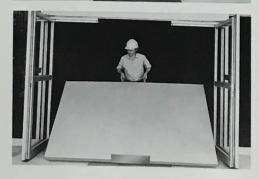
#### Specifics about sliding entrances.

Trim 4"-wide frames can easily be incorporated into new construction or remodeling. Either Stanley series can be used with a dependable pneumatic operation, or with a simple plug-in electric operator we call Magic-Slide. An all-weather compressor-dryer system, now available for pneumatic operation, eliminates humidity/freezing problems in all climates. The Magic-Slide operator requires only 115v., 60 cycle current at the header.

#### How we help you do things right.

Your nearby Stanley Magic-Door® Distributor will do a lot more than just tell you about Auto-Slide automatic sliding entrances. He'll put them in. And he'll service them. And he'll make sure they do everything our design engineers say they will. Quality automated doors and the most experienced people in the business. That's what you get from the leader. We're the famous Magic-Door people—the Door Operating Equipment Division of The Stanley Works.





#### Automatic Slide

Both 6000 and 5000 series.

Saves space. Permits two-way traffic. Better looking. Unaffected by strong winds or internal heating or cooling systems.

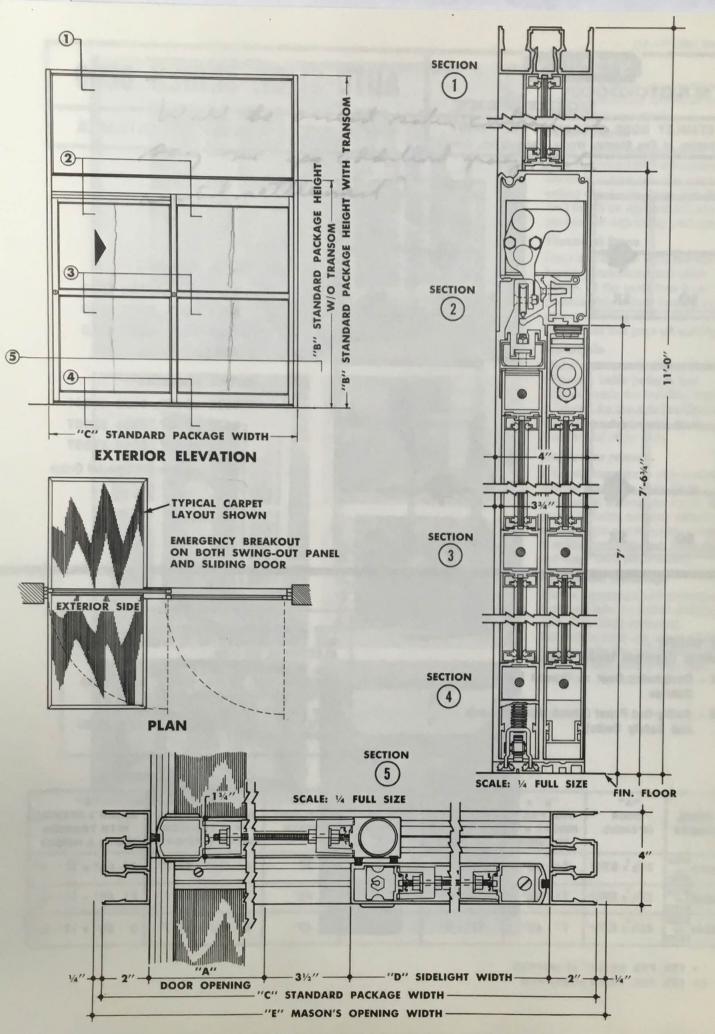
#### Breakaway exit

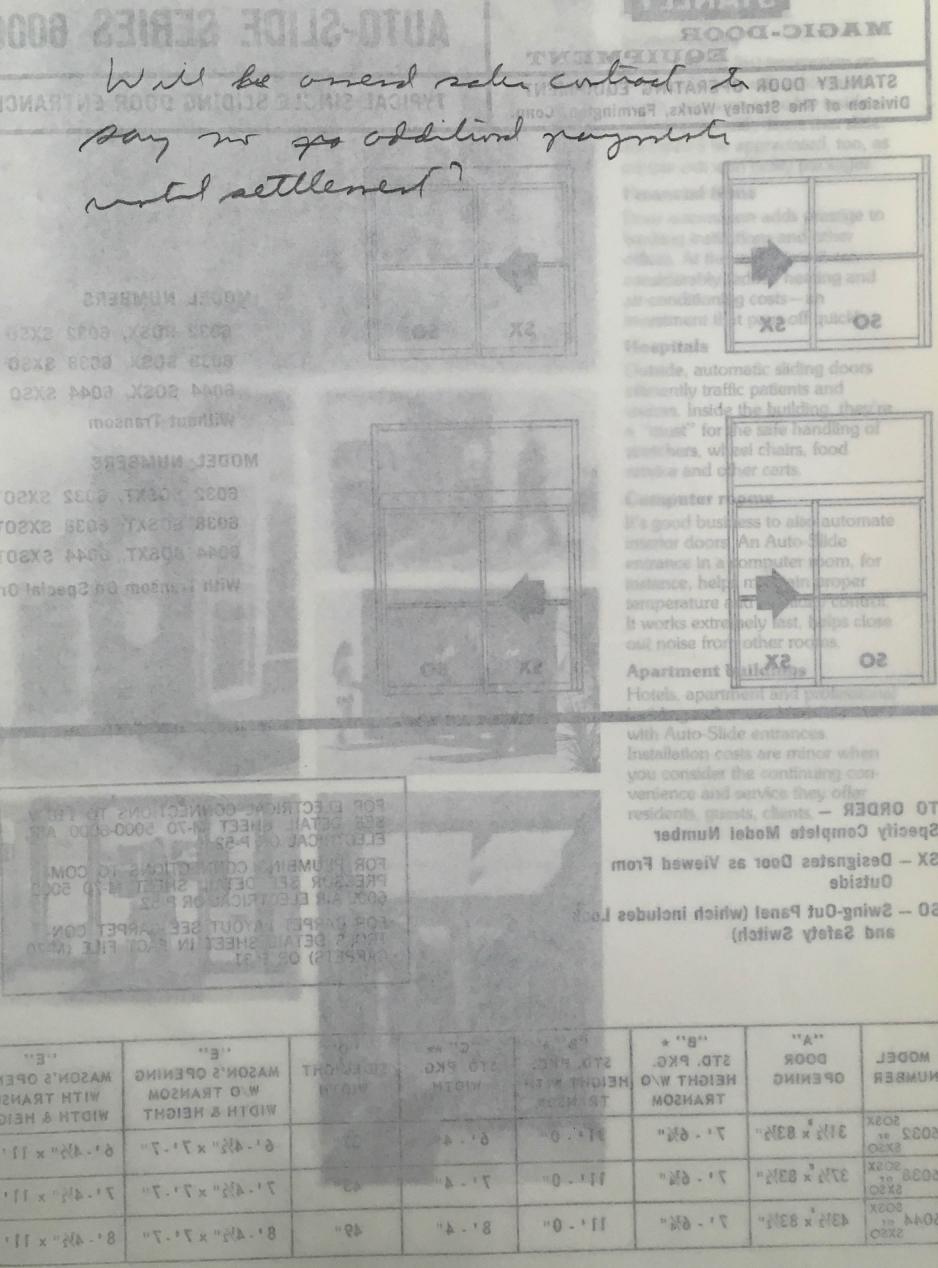
6000 series only.
Swings open for emergency use with slight push. Works even if sliding door is partially open. Provides fast, efficient egress for public entrances. Meets exit code requirements.

#### Wide-open door

6000 series only.

Permits opening of entire entrance. Exclusive design lets large objects through. Openings available large enough to accommodate wide carts and cars. Opens room to pleasant outdoor weather.





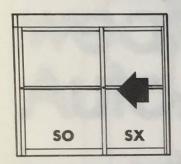
#### STANLEY

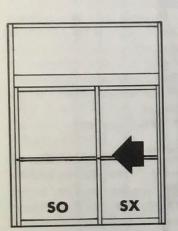
MAGIC-DOOR EQUIPMENT

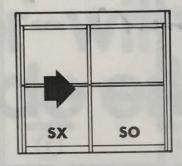
STANLEY DOOR OPERATING EQUIPMENT Division of The Stanley Works, Farmington, Conn.

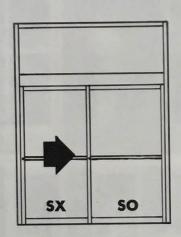
### **AUTO-SLIDE SERIES 6000**

TYPICAL SINGLE SLIDING DOOR ENTRANCE









#### MODEL NUMBERS

6032 SOSX, 6032 SXS0 6038 SOSX, 6038 SXS0 6044 SOSX, 6044 SXS0 Without Transom

#### MODEL NUMBERS

6032 SOSXT, 6032 SXSOT 6038 SOSXT, 6038 SXSOT 6044 SOSXT, 6044 SXSOT With Transom On Special Order

TO ORDER — Specify Complete Model Number

SX — Designates Door as Viewed From Outside

SO — Swing-Out Panel (which includes Lock and Safety Switch)

FOR ELECTRICAL CONNECTIONS TO 110 V. SEE DETAIL SHEET M-70 5000-6000 AIR, ELECTRICAL OR P-52

FOR PLUMBING CONNECTIONS TO COM-PRESSOR SEE DETAIL SHEET M-70 5000-6000 AIR ELECTRICAL OR P-52

FOR CARPET LAYOUT SEE CARPET CONTROLS DETAIL SHEET IN FACT FILE (M-70 CARPETS) OR P-31

MODEL NUMBER	"A" DOOR OPENING	"B" * STD. PKG. HEIGHT W/O TRANSOM	"B" * STD. PKG. HEIGHT WITH TRANSOM	"C" ** STD. PKG. WIDTH	"D" SIDELIGHT WIDTH	"E" MASON'S OPENING W/O TRANSOM WIDTH & HEIGHT	"E" MASON'S OPENING WITH TRANSOM WIDTH & HEIGHT
SOSX 6032 or	31½ × 83½"	7' - 6¾"	11' - 0"	6' - 4"	37"	6'-4½" x 7'-7"	6'-4½" x 11'-¼"
6038 or	37½ × 83½"	7' - 63/4"	11' - 0"	7' - 4"	43"	7'-4½" x 7'-7"	7'-41/2" x 11'-1/4"
SOSX 6044 or SXSO	43½ × 83½"	71 - 634"	11'-0"	8'-4"	49"	8'-4½" x 7'-7"	8'-4½" x 11'-¼"

<sup>\*</sup> STD. PKG. HEIGHT AS SHIPPED

<sup>\*\*</sup> STD. PKG. WIDTH AS SHIPPED













#### Food stores

Customers today have come to expect automated entrances in markets big and small.

#### Liquor stores

Make a better first impression on your customers with automated doors. You save valuable inside selling space with doors that slide. And they'll be appreciated, too, as people exit with bulky packages.

#### Financial firms

Door automation adds prestige to banking institutions and other offices. At the same time it can considerably reduce heating and air-conditioning costs—an investment that pays off quickly.

#### Hospitals

Outside, automatic sliding doors efficiently traffic patients and visitors. Inside the building, they're a "must" for the safe handling of stretchers, wheel chairs, food service and other carts.

#### Computer rooms

It's good business to also automate interior doors. An Auto-Slide entrance in a computer room, for instance, helps maintain proper temperature and humidity control. It works extremely fast, helps close out noise from other rooms.

#### Apartment buildings

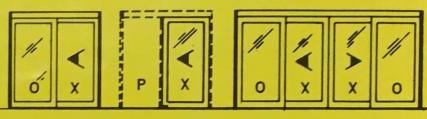
Hotels, apartment and professional buildings take on added distinction with Auto-Slide entrances. Installation costs are minor when you consider the continuing convenience and service they offer residents, guests, clients.

#### Details Auto-Slide® series

#### **Details Auto-Slide series**







Model numbers 6032 SOSX or SXSO

6038 SOSX or SXSO 6044 SOSX or SXSO Without transom,

With transom on special order.

\*NOTE: Intermediate rail is standard equipment. All sidelights swing.

Model numbers 6639 6651

Without transom. With transom on special order.

Model numbers 50320X or XO 50380X or XO 50440X or XO

Without transom. With transom on special order.

Model numbers 5032PX, or XP 5038PX, or XP

5044PX, or XP

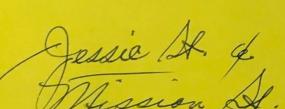
Model numbers 5539 5551 5563

Without transom. With transom on special order.

Model numbers 5539

5551 5563

†NOTE: Intermediate rail on special order. Specify SO if



6863



#### Dimensional data for 6000 and 5000 Auto-Slide series

Numbe	Door r Opening	Std. Pkg. Height W/O Transom	Std. Pkg. Height With Transom	Std. Pkg. Width	Side- Light Width	Mason's Opening W/O Transom Width & Height	Mason's Opening With Transom Width & Height
6032 5032	31⅓" x 83½"	7'-6¾"	11'-0"	6'-4"	37"	6'-4½" x 7'-7"	6'-4½" x 11'-¾"
<del>2</del> 6038 5038	37½" x 83½"	7'-634"	11'-0"	7'-4"	43"	7'-4½" x 7'-7"	7'-4½" x 11'-¼"
6044 5044	43½" x 83½"	7'-6¾"	11'-0"	8'-4"	49"	8'-4½" x 7'-7"	8'-4½" x 11'-¾"
6639 5539	39" x 83½"	7'-6¾"	11'-0"	8'-4"	25"	8'-4½" x 7'-7"	8'-4½" x 11'-¼"
6651 5551	51" x 83½"	7'-6¾"	11'-0"	10'-4"	31"	10'-4½" x 7'-7"	10'-4½" x 11'-¼"
6663 5563	63" x 83½"	7'-6¾"	11'-0"	12'-4"	37"	12'-4½" x 7'-7"	12'-4½" x 11'-¼"

To order specify model number and panel codes as viewed from outside.

O-fixed panel

SO - swing-out panel

X-sliding door

SX - swing-out sliding door

P-pocket or wall (no panel)

(Further detailed specifications available on request)

STANLEY MAGIC DOOR EQUIPMENT DIVISION OF THE STANLEY WORKS 501 OLD COUNTY RD. + SAN CARLOS, CALIF. 94070 PHONE 592-2501



Stanley Door Operating Equipment **Division of The Stanley Works** Farmington, Connecticut 06032 Telephone (203) 677-2861

helps you do things right



## AUTO-SLIDE® AUTOMATIC DOOR OPERATOR



Welcome business, in any weather, with an Auto-Slide entrance.

## PNEUMATIC-OPERATED, AUTOMATIC SLIDING DOOR FOR ALL SEASON DEPENDABILITY

SUGGESTED APPLICATIONS:
ALL COMMERCIAL FIRMS,
INSTITUTIONS, HOTELS/MOTELS,
APARTMENT BUILDINGS, ETC.

Have freezing rain, ice, slush or high humidity made sliding doors seem impractical for your needs? Stanley's all-weather Auto-Slide door operator solves such problems with an efficient, combination air compressor and drying system.

**Simple** – A factory-mounted air dryer on the compressor removes moisture from the air, minimizing repairs and service.

Attractive – No matter what business you're in, the Auto-Slide entrance provides it with new dimensions of prestige, customer convenience and service. Because it responds so quickly, it helps conserve heating and air conditioning energy. It also lets you make use of valuable floor space.

Versatile – You can design a single sliding door or synchronized bi-parting doors using the same compressor. In an emergency, the doors may be swung open with a slight push for fast, efficient egress. Stanley's exclusive design, also, permits wide opening of the doors in order to move large objects through – or to open the room to pleasant outdoor weather.



#### **AUTO-SLIDE® OPERATOR**

With Air Dryer/Compressor



Air from dryer/compressor keeps doors functioning smoothly even in freezing or high humidity conditions.



Door may be pushed open for emergency egress.



Doors also may be opened wide to bring in large objects or expose room to outside fair weather.

#### **COMPRESSOR FEATURES**

Stanley's refrigeration-type compressed air dryer provides a continuous stream of dry, clean, compressed air while disposing of condensed moisture and entrainments. Helps reduce service, callbacks and maintenance. Also helps increase the performance of the entire pneumatic system.

#### **OTHER FEATURES**

- 1. Compressor: Two stage with 3 x 1½" bore and 2" stroke. Crank case capacity to be 1½ pints. Compressor unloading accomplished by means of centrifugal unloader.
- 2. Controls: Start-Stop.
- **3.** Belt Guard: Totally Enclosed.
- 4. Automatic Tank Drain Piped to Tank.
- **5.** Air Dryer: Refrigerated Type 35° Mounted and Piped.
- **6.** Automatic Drain Piped To Compressed Air Dryer.
- **7.** Filter/Silencer: Dry Type on Compressor Intake.
- **8.** Pressure Gauge: 0-200 PSI.
- **9.** Air Shut Off Valve at Outlet of Compressed Air Dryer.

## STANLEY helps you do things right

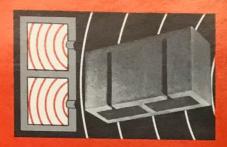
### STANLEY DOOR OPERATING EQUIPMENT

Division of The Stanley Works Farmington, Conn. 06032

#### RAY CARSON COMPANY, INC.

4250 BROADWAY • DENVER, COLORADO 80216 • PHONE [303] 892-9337

MESSAGE	REPLY
MR FRANK WI. RhEA 7	DATE
DENVER, COLO80204 J DATE JUNE 26,1974	
I talked to you on	
Dueling for the new Ment	
Ofer es som enformation on a product that is	
particularly suitable for are industrial application such as the Merth.	
By Ray Carson.	SIGNED RING 6/28/
Form N.R73R The Drawing Board, Inc., Box 505, Dallas, Texas  INSTRUCTIONS TO SENDER:  1. KEEP YELLOW COPY. 2. SEND WHITE AND PINK COPIES WITH CARBON INTACT.  1. WRIT	E REPLY. 2. DETACH STUB, KEEP PINK COPY, RETURN WHITE COPY TO SENDER.



## DUNDBLOX®

#### SOUND ABSORBING STRUCTURAL MASONRY UNITS

- OUTDOOR NOISE SCREENS
- INDUSTRIAL PLANTS
- RETURN AIR SHAFTS
- COMPUTER ROOMS
- MUSIC ROOMS
- **NATATORIUMS**
- **AUDITORIUMS**
- GYMNASIUMS





Exhibition Hall, Cultural Center for the Arts, Canton, Ohio. Architects: 50,000 SOUNDBLOX Units Quiet This Eastern Airlines L-1011 Overhaul and Ma Lawrence, Dykes, Goodenburger & Bower, Canton. Acoustical Consultants: tenance Hangar in Miami. Architects-Engineers: Connell Associates, Inc., Mia Christopher Jaffe, Inc., Norwalk, Conn.

attractive, economical sound control for indoor/outdoor construction



The Proudioot Company, Inc. ACOUSTICAL PRODUCTS 1974



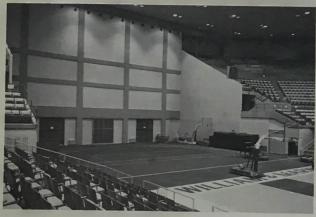
SOUNDBLOX units offer an attractive, efficient and economical means for acoustical correction and noise control. They are made near the jobsite by selected block producers using special molds which fit standard automatic block machines.

They are readily available in all areas of the country.

SOUNDBLOX derive their excellent sound absorption from a patented cavity-slot construction. The cavities are closed at the top and the slots allow the closed cavities to act as damped (Helmholtz) resonators.

SOUNDBLOX are load-bearing structural units having the same high compressive strength as ordinary concrete blocks. They are installed conventionally, without added labor, making their in-place cost low in comparison to most other acoustical materials. Rugged durability permits the use of SOUNDBLOX units in walls of industrial plants, gymnasiums, etc. where acoustical treatment is often most advantageously placed.

SOUNDBLOX units are approved for use in reinforced masonry construction wherever ordinary hollow concrete masonry units are permitted. This applies to number 3 or lesser seismic zones, as defined under the Uniform Building Code, with 90% of the shear value of ordinary hollow masonry units allowed for the SOUNDBLOX units. See Research Recommendation No. 2539 of the International Conference of Building Officials.



Gymnasium, College of William and Mary, Williamsburg, Va. Architects: Wright, Jones & Wilkerson, Richmond. SOUNDBLOX produced by: Southern Pipe & Block Corp., Chesapeake, Va.



Effluent Pump Room, Hartford Water Pollution Control Plant, Hartford, Conn. Engineers: Metcalf & Eddy, inc., Boston. SOUNDBLOX produced by: Plasticrete Corp., Hartford.

SOUNDBLOX units are covered by U.S. Patent Nos. 2,933,146-3,506,089 and Canadian Patent No. 868,312.

#### TYPES AND USES

The A series (Types A and A-1) have narrow slots and unfilled cavities.

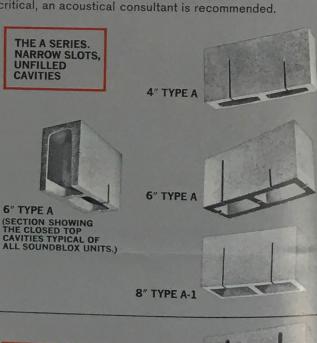
The B series (Types B and BB) have wider slots and specially fabricated, incombustible, fibrous filler elements in the cavities.

Three-cavity units (Type BB) are available only in 8" thickness. NO SOUNDBLOX UNITS ARE CURRENTLY AVAILABLE IN 10" or 12" THICKNESSES.

ALL SOUNDBLOX units have their maximum sound absorption at low frequencies where it is generally of greatest advantage. They are useful in many types of areas: industrial plants, gymnasiums, natatoriums, mechanical equipment rooms, fan rooms, etc. As shown by the test data on the opposite page, walls constructed of SOUNDBLOX units also have substantially better sound transmission loss characteristics (STC) than walls of comparable ordinary blocks.

For outdoor applications and for areas of very high humidity such as natatoriums, etc., use of the A Series units (without filler elements) is recommended. The B Series units (with wider slots and filler elements) are generally best kept above door heights in schools and public areas.

General advice on the type, size and quantity of SOUND-BLOX units to use for best results is available from The Proudfoot Company, Inc. and its Franchisees. For more specific advice and where acoustical conditions are critical, an acoustical consultant is recommended.



THE B SERIES.
WIDER SLOTS;
CAVITIES HAVE
INCOMBUSTIBLE
FIBROUS FILLER
ELEMENTS

4" TYPE B

8" TYPE B

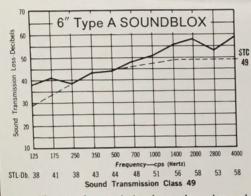


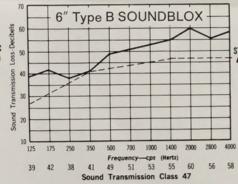
6" TYPE B SHOWN ON COVER 8" TYPE BB

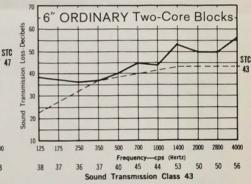
Size			Cavities/	FREQUENCY — Hertz						
	Туре	Surface	Slots	125	250	500	1000	2000	4000	NRC Range
4"	A	UNPAINTED	2/2	.19	.83	.41	.38	.42	.40	.4555
6"	A	PAINTED	2/2	.62	.84	.36	.43	.27	.50	.4555
8"	A-1	PAINTED	2/2	.97	.44	.38	.39	.50	.60	.4050
4"	В	PAINTED	2/2	.20	.95	.85	.49	.53	.50	.6575
6"	В	PAINTED	2/2	.31	.97	.56	.47	.51	.53	.6070
8"	В	PAINTED	2/2	.74	.57	.45	.35	.36	.34	.4050
8"	ВВ	PAINTED	3/3	.60	.72	.56	.48	.46	.47	.5060

The values shown in the table above were determined by ASTM methods at the acoustical laboratories of Geiger & Hamme, Inc., Ann Arbor, Mich.

#### SOUND TRANSMISSION LOSS CHARACTERISTICS







The sound transmission loss values shown above were determined in accordance with ASTM methods by Kodaras Acoustical Laboratories, New York City. All blocks for the tests were made from the same light

weight aggregate (50% Waylite-50% sand) and all walls were painted on the unslotted side with two coats of Bondex cement base paint before testing.

#### FIRE ENDURANCE

Fire testing in accordance with ASTM E119-67 requirements and supplementary pilot tests show fire endurance ratings of up to 3

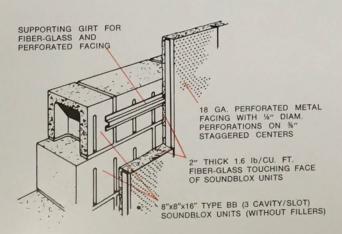
hours plus for load-bearing walls built of SOUNDBLOX units. Specific details will be supplied upon request.

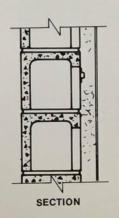
### SOUNDBLOX UNITS WITH FACING OF FIBER-GLASS AND PERFORATED METAL NOW PROVIDE A NEW DIMENSION IN SOUND ABSORPTIVE TREATMENT FOR WALLS.

The sound absorption values shown at right were determined in accordance with ASTM Designation C423-66 by Geiger and Hamme Acoustical Laboratories for the system detailed:

#### SOUND ABSORPTION COEFFICIENTS

125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	NRC Range	
.80	.97	1.02	.90	.77	.71	85-95	

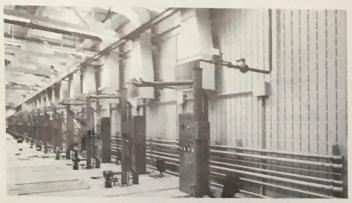




The sound absorptive walls detailed, in combination with an absorptive ceiling, offer the possibility in some circumstances of providing a substantial degree of protection to a machine operator from the noise of his own machine by use of a visually transparent screen between the operator and the machine. The general noise level is reduced by the high sound absorption of the walls and ceiling and the reflected noise of the machine from a wall behind the operator is reduced substantially by the high sound absorption of that surface.



#### TYPICAL INSTALLATIONS



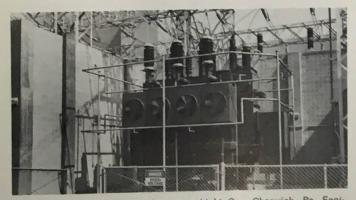
Diesel Engine Test Facilities, Detroit Diesel Engine Division, General Motors Corporation. Architects: Argonaut Realty Division, GMC. SOUNDBLOX produced by: Haycon Corporation, Detroit.



Computer Center, Farmlands Industries, Inc., Kansas City, Missouri. Architects: Radotinsky-Deardorff & Associates, Kansas City, Kansas. SOUNDBLOX produced by: City Block & Products Company, Independence, Missouri.



Home Economics Room, Middle Island Middle School, Middle Island, L.I., N.Y. Architects Engineers: Frederic P. Wiedersum Associates, Valley Stream, L.I., N.Y. SOUNDBLOX produced by: Sal Picone & Sons, Melville, L.I., N.Y.



Transformer Noise Screen, Duquesne Light Co., Cheswick, Pa. Engineers: Stone & Webster Engineering Corp., Boston, Mass. SOUNDBLOX produced by: R. I. Lampus Co., Springdale, Pa.

In addition to the areas pictured, many millions of SOUNDBLOX units are now in use in thousands of industrial plants, schools and other types of buildings. A list of hundreds of major users will be sent on request.

#### **SPECIFICATIONS**

Scope. Sound absorptive concrete masonry units shall be used to construct the exterior or interior walls or partitions as shown on the plans and/or indicated in the Schedule of Finishes.

Material. All sound absorptive masonry units shall be SOUNDBLOX made on standard block machines from molds furnished by The Proudfoot Company, Inc., Greenwich, Connecticut. They shall be made of carefully prepared aggregate and shall meet the current ASTM C-90 or ASTM C-129 requirements as appropriate. Carefully controlled use of the SOUNDBLOX molds shall be employed so that all units have one end of the cavities tightly closed. Slots and edges shall be straight and clean. Where Type B or Type BB SOUNDBLOX units are called for, filler elements as supplied by The Proudfoot Company shall be installed in the cavities of the blocks at the block plant. The filler elements shall be of specially fabricated incombustible fibrous material, cut accurately to size and installed as recommended for the type of SOUNDBLOX units that are called for.

Sizes and Types. SOUNDBLOX units shall be 8" x 16" nominal face size. They shall be of the thickness (4", 6" or 8") and Type (A, A-1, B, or BB) as shown on the plans and/or indicated in the Schedule of Finishes.

Installation. SOUNDBLOX units shall be installed by the General Contractor (or Masonry Contractor) using only mechanics skilled in the laying of masonry blocks. All necessary cutting on the jobsite shall be performed with power tools in such a manner as to provide straight and true edges. No chipped or broken blocks shall be used. SOUNDBLOX units shall be laid in running-bond (or stack-bond) with the open side of the cavities facing downward. The slots shall be exposed to the area where the sound absorption is desired as indicated on the plans. Care shall be taken to insure that the slots are kept free of mortar or debris above the mortar joints. Lines shall be straight and true and the SOUNDBLOX workmanship shall otherwise conform to all requirements of the General Specifications for masonry work.

RAY CARSON COMPANY 4250 BROADWAY DENVER, COLORADO 80216 (303) 892-9337



P. O. Box 9, Greenwich, Connecticut 06830 Telephone: (203) 869-9031

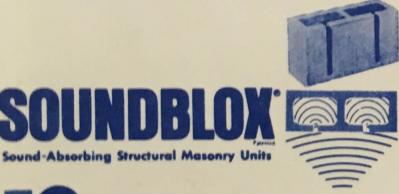


80,000 SOUNDBLOX, sound absorbing structural masonry units on the walls quiet this GENERAL MOTORS CORPO-RATION diesel engine test facility in Detroit. See reverse side for more information.

## Masonry blocks provide built-in NOISE POLLUTION CONTROL

Architects and engineers at the Argonaut Realty Division of General Motors Corporation selected SOUNDBLOX sound absorbing structural masonry units to quiet the huge diesel engine test facility pictured on the reverse side. 80,000 SOUNDBLOX units were installed in the walls of this building which is used by GMC's Detroit Diesel Engine Division.

For complete technical information see Sweet's Architectural or Industrial Construction Files (9.1/Pr) or phone us collect at the number below.





PLACE STAMP HERE MADE IN U.S.A K-20810

## POST-CARD

## Wheeling Corrugating Company

A DIVISION OF WHEELING-PITTSBURGH STEEL CORPORATION

Robert J. Smith Englewood, Colo.
Sales Representative

450 White Like Dr. 7

Florisant, Mo. 2008

Home Phone: 31-20038

303-770-6120

Apt. D

Lenexa, Kansas

66215

District Office:
Phone: 31-20038

Phone: 31-20038

913-888-4900

Denver Mint 320 W. Colfax Denver, Colorado 80204

Attn: Mr. Frank Rhea

Dear Mr. Rhea:

Confirming our telephone conversation of November 27, 1973, concerning the new Denver Mint, please find enclosed literature on Wheeling Grid-Crete and Wheeling Steelcrete reinforcing mesh.

Grid-Crete has been used in the vaults of numerous banks across the country, offering economical installation while providing the maximum security required. Steelcrete is consistently specified by the Federal Reserve Board, washington, D.C. and offers the upmost in security - providing a 10R insurance rating. Steelcrete also offers economy of installation while remaining competitively priced.

In today's steel market, availability is more and more the key word. The alternative to the Wheeling bank vault systems is re-bar. As you probably know, everyday re-bar is becoming increasingly harder to get and the prices are soaring. Why pay more and at the same time take the chance of naving your job delayed because you can't get the material?

Grid-Crete and Steelcrete bank vault systems are readily available.

Wheeling Corrugating Company manufactures a wide range of steel building products in addition to our bank vault systems. Some of these catalogues are also enclosed.

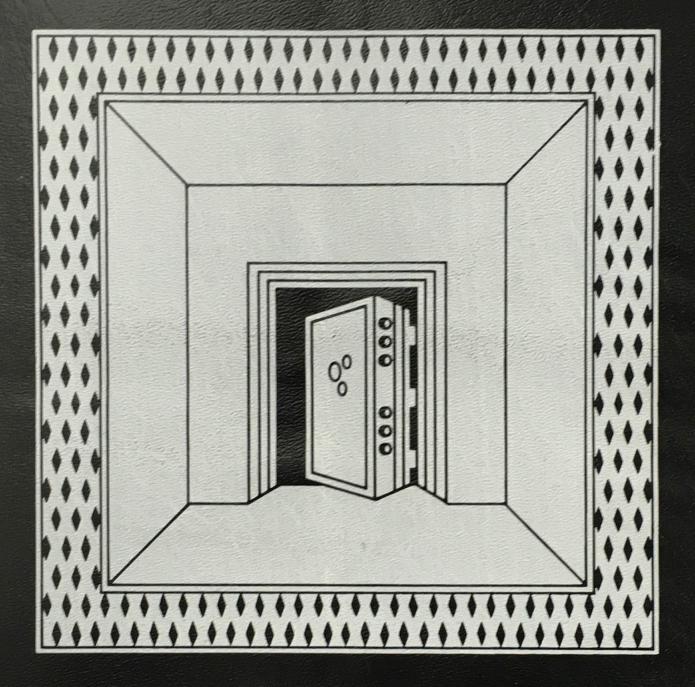
We are looking forward to the prospect of working with you in whatever way we can. Please feel free in contacting me if I can be of further service.

Sincerely,

Robert J. Smith

Sales Representative Wheeling Corrugating Co.

a Div. of Wheeling-Pittsburgh Steel Corp.



## Wheeling Bank Vault Systems



A DIVISION OF WHEELING-PITTSBURGH STEEL CORPORATION

## Steelcrete Bank Vaults save your money and save you money.





STEELCRETE Vaults are providing dependable security in many banks including the following installations:

Cullen Center Bank & Trust Company Houston, Texas

Fidelity National Bank Lynchburg, Virginia

Bank of Nova Scotia New York, New York

First National Bank Louisville, Kentucky

Western & Southern Life Insurance Company Cincinnati, Ohio

Fort Worth National Bank Fort Worth, Texas

First National Bank of Tampa Tampa, Florida

Worchester County National Bank Worchester, Massachusetts

First National Bank Fort Lauderdale, Florida

Grand Avenue, Crown Center Bank Kansas City, Missouri

Commerce State Bank & Trust Topeka, Kansas

Liberty Tower Bank Building Oklahoma City, Oklahoma

Federal Reserve Bank Minneapolis, Minnesota

Bank of Cleveland Cleveland, Ohio

First National Bank Building Omaha, Nebraska

Fidelity Bank Philadelphia, Pa.

First Maryland Building Baltimore, Maryland

Northampton Institution for Savings Northampton, Massachusetts

First National Bank of Oregon Portland, Oregon

Middlesex Bank Burlington, Massachusetts

Essex County Bank Peabody, Massachusetts

Linwood State Bank Kansas City, Missouri

Lincoln National Bank Syracuse, New York

Crocker Citizens Plaza Los Angeles, California

## Beyond the door

When most people think of a vault, they are really thinking of the door . . . that huge mass of shiny steel with combinations and time locks. A vault is a lot more than that.

A vault is an entire room in which to store valuables. It is designed to withstand all the efforts of man and nature to penetrate it. But naturally, given equipment and time, anything can be penetrated. The function of a bank vault then, is to resist penetration for the longest period of time. It is on this basis that vaults are rated, tested, specified and purchased. It is on this basis that STEELCRETE Bank Vault systems are outstanding.

## Steelcrete

STEELCRETE is our name for an inter-related network of sheets of heavy expanded metal and reinforcing rods embedded and interlaced within the concrete walls and slabs of a bank vault. The key words in the description are "heavy metal." STEELCRETE is not what is normally thought of as expanded metal, but instead it is a thick sheet of steel with diamond shaped openings. It weighs 3.63 lbs. per square foot. Its strands are increased in yield strength and its surfaces hardened by the expanding process, thus providing more resistance to cutting and drilling.

A STEELCRETE vault wall generally consists of 16" wide vertical steel sheets placed perpendicularly to the wall. The whole system is then filled and covered with concrete. The result is one of the strongest rooms ever built.

## Important Vault Considerations

#### For Bankers:

- 1. Insurance at the lowest cost.
- 2. The STEELCRETE system is the only system consistently specified by the Federal Reserve Board, Washington, D.C.
- 3. Our system exceeds the requirements of the Insurance Services Office for highest rating (10R) and The Federal Bank Protection Act's requirements.
- 4. No Steelcrete Vault has ever been broken into. Competitive systems have
- 5. The system offers many installation economies which make a completed STEELCRETE Vault competitive in price with any other system.
- 6. STEELCRETE systems install faster. This means earlier occupancy for you.

## For Architects and Engineers:

- 1. The STEELCRETE system installs easily and quickly . . . less fabricating than bar systems.
- 2. STEELCRETE vaults save valuable floor space. 0.75 square feet per lineal foot of perimeter.
- 3. STEELCRETE vaults have structural strength as well as security value.
- 4. The STEELCRETE system arrives complete with a full bill of materials, field and erection drawings, and erection procedures.

## Security and Economics

As stated earlier, the primary function of a vault is to resist penetration for the longest period of time. Tests have proved that concrete with an embedment of entangled steel strands throughout offers greater protection than reinforcing bars placed in a few planes in concrete. STEELCRETE provides this. Here's how STEELCRETE systems stand up.

Drilling—An 18" thick wall reinforced with 16" STEELCRETE mats will resist penetration by a diamond core drill 47% longer than a 27" thick wall reinforced with four, 4-inch grids of #5 reinforcing bars.

Explosions—The positioning of STEELCRETE sheets in walls, perpendicular to the face of the walls, provides more resistance to explosions than bar grids placed parallel to wall faces.

Prying and Wedging—As STEELCRETE sheets contain few ties or welds, they provide greater resistance to prying, wedging or removal than competitive systems.

Floor space—An 18" thick STEELCRETE wall gives more protection and the same insurance rating as a 27" thick wall utilizing reinforcing bars. This means, size for size, our vault takes less valuable floor space, and provides greater security. It actually saves 0.75 square feet per lineal foot of vault perimeter.

Structural costs—A STEELCRETE system is lighter in weight than any rebar system having the same insurance rating. An 18" STEELCRETE wall weighs less than a 27" rebar system wall. Less weight means lower structural costs with STEELCRETE systems.

Structural Strength—The STEELCRETE system provides resistance to fire, water, earthquakes, tornadoes, and falling objects. It it designed to meet safe load requirements.

**Burglary**—No STEELCRETE vault has ever been broken into by burglars.

There are several kinds of costs to consider in the selection of a vault system. They all should be factored in and weighed when making the decision.

Materials—Admittedly, STEELCRETE sheets cost more per pound than bars for an ordinary system because it is pre-fabricated. But you are saving one-third the amount of concrete used in a rebar system.

Construction—Here's where you really save. Because STEELCRETE is in pre-fabricated sheets, it goes in faster. Crews are simply positioning 16" wide sheets. There is less tying than in bar systems. Generally speaking, based on job conditions, the cost of installing a STEELCRETE system is 30% to 50% less than that of installing and tying individual reinforcing bars for a 27" wall.

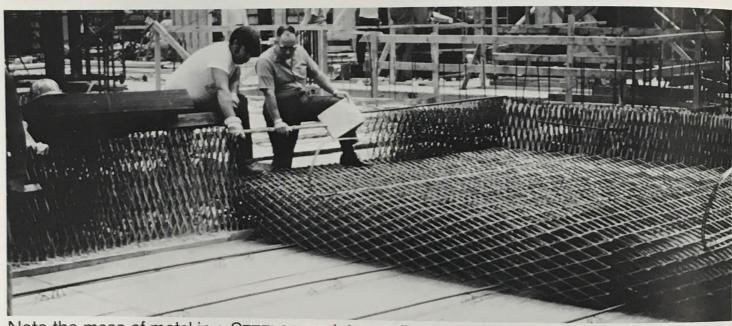
Insurance — The Insurance Services
Office's 10R security rating is the highest
classification recognized by insurance
companies. It allows you extra burglary
insurance at the lowest cost. STEELCRETE
systems meet the requirement for a 10R
rating. Upon completion of installation,
Wheeling Corrugating Company provides
a certificate to meet maximum rating
classification.

Cost of resistance—STEELCRETE systems provide the lowest unit cost per hour of resistance of any known systems.

## This has never happened to Steelcrete



## Typical Steelcrete Vault Erection Procedure



Note the mass of metal in a STEELCRETE intermediate floor.

1. Leveling slab, if required, or floor form is placed for the floor slab.

Starting point for vault should be at the option of the contractor.

NOTE: All steel should be adequately braced during installation.

Place floor support bar chairs and install support bars.



STEELCRETE arrives in easily handled bundles.

- Anchor perforated strap and mark every fifth hole for spacing and fastening of sheets.
- Alternate procedure for placing floor and wall sheets.
  - a. Place floor (or wall) sheets with tie bars continuously throughout the floor (or wall).
  - b. Place floor sheets alternately with adjacent wall sheets.

NOTE: A segment of the area under construction, usually a section about 5'-0" (24 sheets) is erected at a time, until the entire floor and wall is completed.

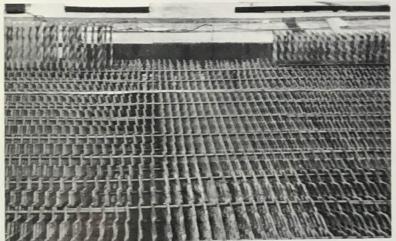
6. Roof STEELCRETE sheets are installed in a similar procedure to floor sheets.

7. Standard concrete forming and pouring procedures to be followed according to contractor's specifications.

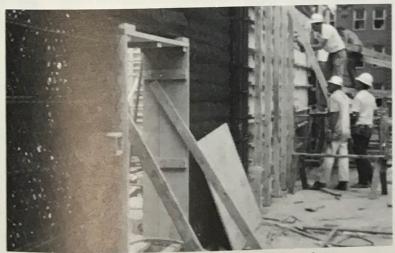
8. Detailed erection procedures are supplied with erection drawings.



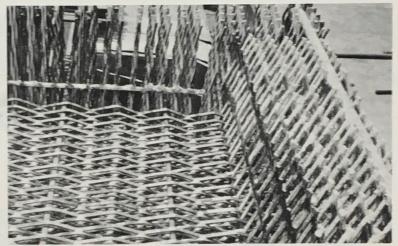
Convenient STEELCRETE sheets speed installation.



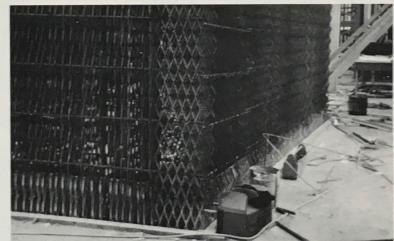
Wall sheets spaced for door opening.



Forms being placed for concrete.



Intermediate floor and walls interweave to eliminate weak spots.



Note the density of the metal in the STEELCRETE system.

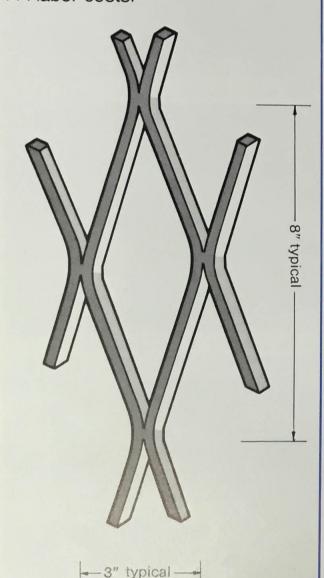


The STEELCRETE pattern permits fast, thorough dispersion of concrete.

## Installation

### **Pre-Fabricated**

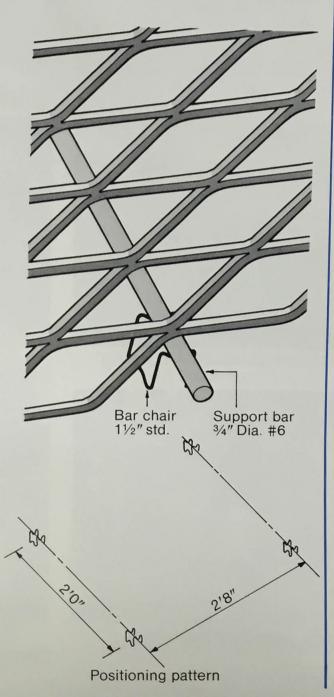
STEELCRETE Systems install easily and quickly as the sheets of the system are pre-fabricated, requiring a minimum of tying and fastening. This reduces the most expensive part of any construction . . . labor costs.



STEELCRETE 3-1-100 Bank Vault Mesh (3.63 lbs. per sq. ft.)

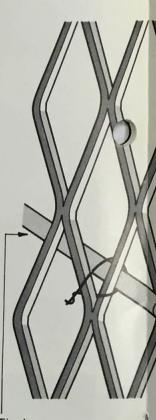
## **Chair Installation**

1½" bar chairs are placed on 2'-0" centers along the length of the #6 support bars. Support bars are placed 2'-8" center to center.



### **Tie Bars**

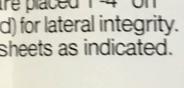
#6 tie bars are center (staggered)
Bars are tied to she

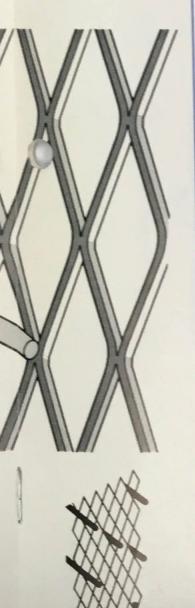


Tie bar <sup>3</sup>/<sub>4</sub>" Dia. #6 with Wire tie

Positioning patter

re placed 1'-4" on d) for lateral integrity.

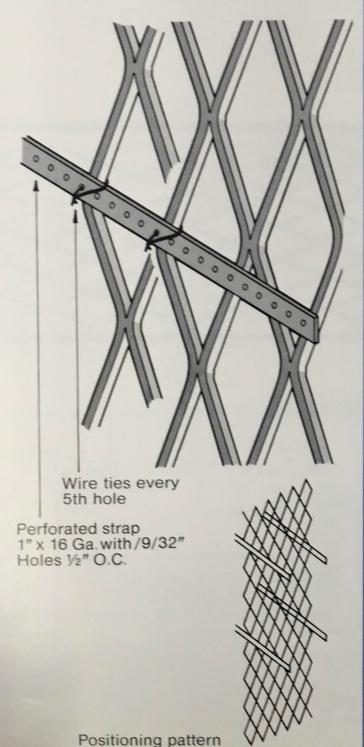




attern

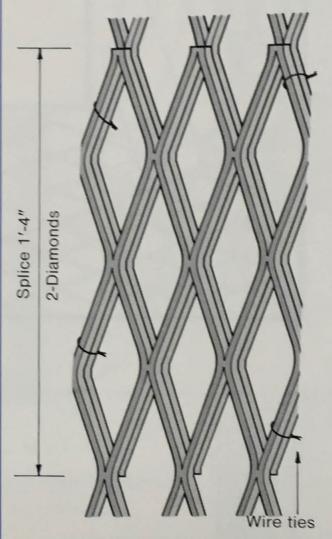
## **Support Straps**

16 gage perforated straps have %2" holes on 1/2" centers. Wire tie every fifth hole. Strap each sheet at two locations on both sides. NOTE: Perforated straps are supplied with system.



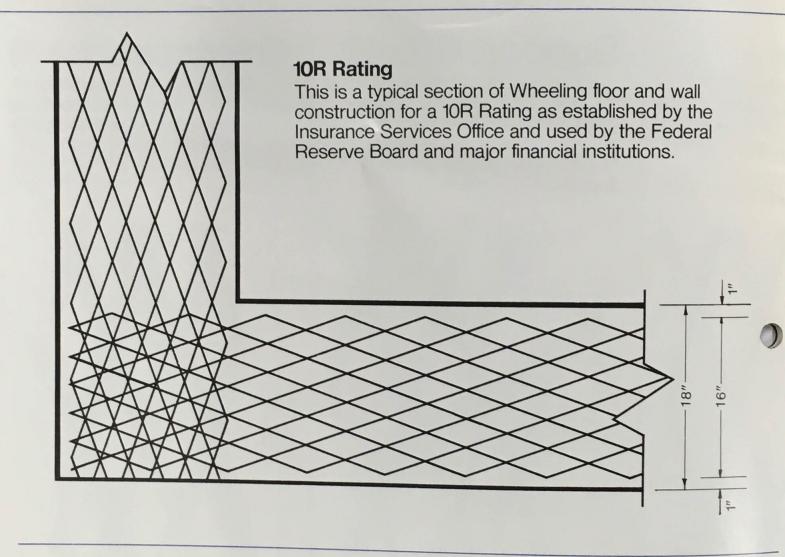
## **Overlaps**

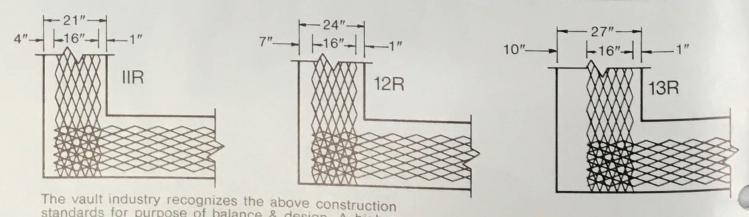
When more than one sheet of STEELCRETE is required, sheets are lapped the length of two diamonds and wire tied.



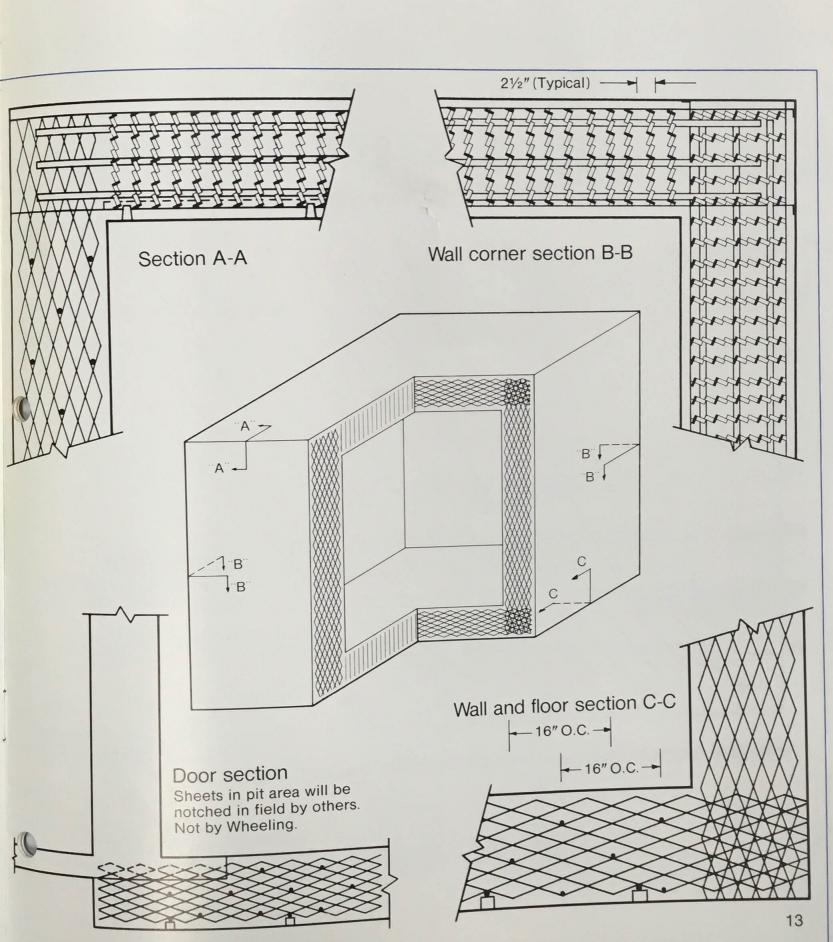
NOTE: Floor and roof chairs and perforated straps are furnished with the STEELCRETE system by Wheeling Corrugating Company. The #6 rebars and tie bars are not furnished by Wheeling but the rebars are detailed and listed with bill of materials.

## Steelcrete Vertical Systems

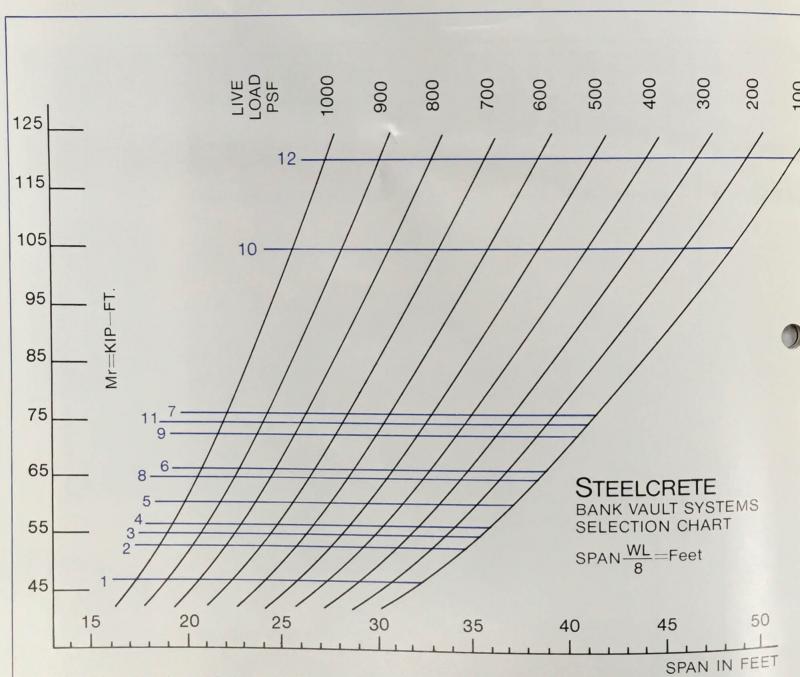




standards for purpose of balance & design. A higher security classification may be obtained by increasing the amount of concrete used with the basic STEELCRETE system.



## Selection Guide



Note: Blue numbers designate the system number shown in chart on page 15.

## RESISTING MOMENTS BANK VAULT VERTICAL SYSTEM SLABS SLAB THICKNESS 18"

MAT DEPTH-16.0"

f'c-3750 PSI

SYS. NO.	REINFORCEMENT (BOTTOM)		Kd (in.)	l <sub>12</sub> γ (in.4)	fc (psi)	fs (psi)	fsc (psi)	Mr (ft. Kips/ft.)	(TOP)	
	BAR NO.	SPACING							BAR NO.	SPACING
1	none	none	5.183	2406.59	1216.4	20,000	15,536.1	47.07		
2	6	15.0"	5.408	2687.26	1297.3	20,000	16,767.7	53.72		
3	6	12.5"	5.451	2741.84	1313.3	20,000	17,011.3	55.05		
4	6	10.0"	5.515	2822.89	1337.2	20,000	17,373.6	57.04		
5	6	7.5"	5.619	2955.56	1376.7	20,000	17,975.0	60.34		
6	6	5.0"	5.818	3212.70	1454.6	20,000	19,162.0	66.93		
7	6	2.5"	6.350	3924.50	1487.2	17,712	20,000.0	76.60		
8	7	7.5"	5.760	3134.36	1431.5	20,000	18,810.6	64.91		
9	7	5.0"	6.016	3467.74	1505.9	19,617	20,000.0	72.34		
10	7	2.5"	5.899	4952.27	1487.2	20,000	19,657.5	104.04	6	2.5"
11	8	5.0"	6.235	3751.08	1493.4	18,340	20,000.0	74.87		
12	8	2.5"	5.987	5741.14	1507.6	19,795	20,000.0	120.47	7	2.5"

STEELCRETE BANK VAULT SYSTEMS

#### Design module indicating placement of steel. 21/2 o/c typical Supplemental top rebar, if required, as noted. (Tied to shoulder of mesh as shown.) Tie bars threaded through diamonds. (3 rows spaced 16" on center) Supplemental positive moment bottom rebar, if required, spaced as noted above. (Tied to shoulder of mesh as shown.) Mesh support bar. (Normally 32" on center) 1= 12" design module -

## Sample Specification

## Specifications for Steelcrete Vertical Type V-16-21/2

**Scope:** This section shall include all materials, equipment and labor necessary for the installation of the concrete vault enclosure, complete, in accordance with this specification and the drawings.

Materials: Reinforcing steel shall be 3-1-100 STEELCRETE Bank Vault Mesh weighing 3.63 lbs. per square foot as manufactured by the Wheeling Corrugating Company, Division of Wheeling-Pittsburgh Steel Corporation, Wheeling, West Virginia.

Installation: The STEELCRETE mats shall be assembled in the floor, walls, and roof of the vault in accordance with the drawings. The mats shall be made of STEELCRETE sheets 16" wide set vertically in rows placed 2½" on center. ¾" diameter steel tie rods shall be used in conjunction with the STEELCRETE mats. These rods shall be placed horizontally through the successive layers of mesh, the equivalent of 3 rods every 16" with irregular spacing. When splicing is necessary, the rods shall lap at least 12." Floor and roof sheets shall overlap those in the walls as shown on the drawings.

The STEELCRETE units shall be spaced and wired rigidly to perforated strap, to form a close fitted rigid mat. Approximately two straps on each side of the mat will be required for STEELCRETE units. Those straps shall be furnished by the Wheeling Corrugating Company. Where necessary, chairs or spacers

shall be used to hold the mat in the position shown on the drawings until the concrete has set.

Any necessary cutting to fit the units around structural steel or concrete openings, etc., shall be done by the placing contractor in the field unless otherwise shown on the drawings.

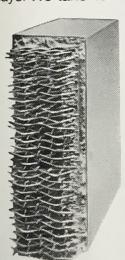
Concrete: Concrete shall conform to the ACI Standard 318-71, "Building Code Requirements for Reinforced Concrete." Aggregate shall be crushed stone or thoroughly washed gravel with a maximum size aggregate of one half inch.

## Special Strength Systems

#### Steelcrete **Horizontal System**

By now, you know that STEELCRETE systems are tough. Here is how to get an even tougher system. Specify the STEELCRETE Horizontal System.

The Horizontal System is just what it says. We take 16" wide sheets of



STEELCRETE expanded metal and stack them horizontally in a wall. Fourteen layers per foot of wall height. To make it even tougher, we alternate the direction of the diamonds in each sheet. (See sketch below.) This presents a tangled mass of metal to withstand just about

anything for a long time.

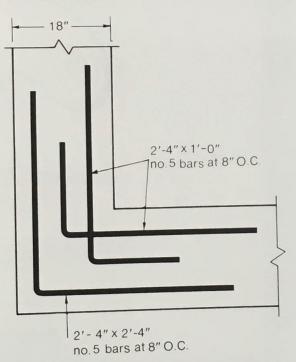
Sheets in the floor and ceiling of this system are placed vertically on 13/4" centers

and supported top and bottom with #6 reinforcing bars.

The steel in the system weighs in at approximately 77 lbs. per square foot of wall area and 66 lbs per square foot of floor or roof.

## Seismic Design

This corner detail is our suggested construction for areas where earth movement is a factor.



# **Certified security**



Wheeling provides this certificate as proof your vault meets Insurance Services Office requirements.

STEELCRETE Bank Vault Systems were originally patented in 1923. Since then, hundreds of systems have been installed in banks all over the world. There has never been one recorded instance of penetration.

Prior to World War II many STEELCRETE Systems were installed in Japan. Some are still in service in spite of all the havoc man and nature have perpetrated in the last 40 years. STEELCRETE Systems structural strength and flexibility has permitted installation over subway tunnels, under two other vaults and around the structural members of existing buildings.

This history of dependable security, as well as versatility of application is your assurance that you are getting the finest with STEELCRETE Bank Vault Systems.

# Sales Offices and Warehouses

ATLANTA, GA. 30340 De Kalb Bldg.—North Park 2801 Clearview Place, N.E. (404) 458-0093

BOSTON, MASS. 01801 10 Wheeling Ave. (617) 935-5550

BUFFALO, N.Y. 14225 1722 Walden Ave. (716) 896-7444

CHICAGO (ITASCA), ILL. 60143 1550 Bryn Mawr Avenue (312) 773-0640

COLUMBUS, OHIO 43212\* 1100 Steelwood Road (614) 486-4318

DETROIT, MICH. 48126 6410 Miller Road (313) 584-2005 GRAND JUNC., COLO. 81501 2749 U.S. Highway 50 (303) 243-1156

HOUSTON, TEXAS 77027 5050 Westheimer Building (713) 622-0040

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LOUISVILLE, KY. 40210 1424 S. 15th Street (502) 634-0541

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N.Y./PHILA. JAMESBURG, N.J. 08831 Wheeling Road (609) 655-3553 N.Y. (212) 784-8580 Phila. (215) 329-1600 OAKLAND, CALIF. 94611 1880 Pleasant Valley Ave. (415) 653-8386

ORLANDO, FLA. 32804\* 2515 Shrader Rd. (305) 295-7572

RICHMOND, VA. 23224 1600 Jefferson Davis Hwy. (703) 232-8916

STATESVILLE, N.C. 28677\* Industrial Drive (704) 872-2471

ST. LOUIS, MO. 63110 722 S. Vandeventer Ave. (314) 531-3900

WHEELING, W. VA. 26003 1134 Market Street (304) 234-2346

\*Warehouse only





# Wheeling Grid-Crete Bank Vault Systems Security with Economy





Leading Banks and Financial Institutions have put their trust and their valuables in Wheeling Grid-Crete Vault Systems

Birmingham Trust National Bank Birmingham, Alabama

Bank of Eclectic Eclectic Alabama

First Federal Savings and Loan Craig, Colorado

**Baltimore Trust Company** Selbyville, Delaware

Palatka Savings & Loan Association Palatka, Florida

Lamar State Bank

Barnesville, Georgia

Bank of Covington Covington, Georgia First National Bank

Griffen, Georgia **Bank of Columbia County** 

Harlem, Georgia

Crawford County Bank Roberta, Georgia

**Banker Trust Company** Relleville, Illinois

Belleville National Savings Bank Relleville, Illinois

**Egyptian State Bank** Carrier Mills, Illinois

Bank of Johnson City Johnson City, Illinois

**Mattoon Bank** Mattoon, Illinois

Central National Bank Greencastle, Indiana

American Fletcher National Bank Indianapolis, Indiana

**First National Bank** Rochester, Indiana

American National Bank Vincennes, Indiana

Martin County Bank Loogootee, Indiana

First Bank & Trust Company Batesville, Indiana

**Henry County** Savings & Loan Assn. Middletown, Indiana

The First National Bank of Danville Danville, Indiana

Merchants Bank and Trust Speedway Branch Indianapolis, Indiana

Chandler State Bank Chandler, Indiana

Citizens Banking Company Anderson, Indiana

Salem Bank & Trust Company Goshen, Indiana

Sioux City Federal Sioux City, Iowa

Rosedale State Bank Kansas City, Kansas

Lenexa State Bank Lenexa, Kansas

Santa Fe Trail State Bank Shawnee Mission, Kansas

**Merchants National Bank** of Bangor

Orono, Maine

Maryland National Bank Baltimore, Maryland

Slades Ferry Trust Company Somerset, Massachusetts

**Essex County Bank** Peabody, Massachusetts

Needham National Bank Bellingham, Massachusetts

Needham National Bank Norwood, Massachusetts

**Fall River Trust Company** Fall River, Massachusetts

Mansfield Cooperative Bank Mansfield, Massachusetts

Lafavette Cooperative Bank Somerset, Massachusetts

State Bank of Standish Standish, Michigan

National Bank of Detroit Metropolitan Airport Office

**National Bank of Detroit** Garden City, Michigan

Commercial Savings Bank Adrian, Michigan

Frankenmuth State Bank Bridgeport, Michigan

**National Bank of Detroit** Lathrup Village, Michigan

Owosso Savings Bank Durand, Michigan

First State Bank Saginaw, Michigan

National Bank of Detroit Grosse Pointe, Michigan

Frankenmuth State Bank Saginaw, Michigan

Genessee Merchants Bank Flint, Michigan

Genessee Merchants Bank Davison, Michigan

J. P. Wallace State Bank Pelican Rapids, Minnesota

First National Bank Elk River, Minnesota

**Drovers State Bank** South Saint Paul, Minnesota

Lamar Trust Company Lamar, Missouri

First State Bank of Shelton Shelton, Nebraska

Nebraska State Savings & Loan Fremont, Nebraska

**Granite State Trust Company** Lincoln, New Hampshire

Merchants Savings Bank Merrimack, New Hampshire

Lincoln National Bank Manlius, New York

Glen Falls National Bank & Trust Co.

Schroon Lake, New York

**Endicott Trust Company** Binghamton, New York

Lincoln National Bank Syracuse, New York

First National Bank of Middletown Middletown, Ohio

Southern Ohio Bank Cincinnati, Ohio

Fifth-Third Bank Norwood, Ohio

Bellbrook Community Bank Bellbrook, Ohio

Fifth-Third Bank Cincinnati, Ohio

First National Bank Zanesville, Ohio

**Austinburg Bank Building** Austinburg, Ohio

**First National Bank** New Carlisle, Ohio

First Bank of Marietta Marietta Ohio

Bank of Russellville Russellville, Ohio

Peoples Savings & Loan Association Xenia, Ohio

First National Bank of Oregon Portland, Oregon

Continental Bank Ambler, Pennsylvania

Old Stone Bank Coventry, Rhode Island

**Fall River Trust Company** West Port, Rhode Island

Old Stone Bank Wakefield, Rhode Island

**Industrial National Bank** Providence, Rhode Island

Industrial National Bank Barrington, Rhode Island

National Bank of South Carolina University Branch, Columbia, S. C.

Bank of Bland

Bland, Virginia

The Peoples Bank Point Pleasant, West Virginia

First Federal Savings & Loan Bluefield, West Virginia

# The hidden security in the vault

A vault is a room with a thick, shiny, heavy, impressive door. Right? Almost. The door is the obvious part and it creates the image of the ultimate in security. But it is the walls, floor and ceiling that make the security complete. They're a thick mass of concrete and steel designed to defy all the efforts to penetrate by man and nature.

But, given time and equipment, anything can be penetrated. The thickest, toughest wall. Time then is the security factor in a vault. And it is the time it takes to penetrate that is the basis for rating, specifying, testing and purchasing bank vaults.

It is on this basis that Wheeling Grid-Crete Bank Vault Systems guarantee a 5R to 9R classification by the Insurance Services Office.

# **Grid-Crete Security**

The basic strength of the Grid-Crete System comes from the metal embedded in the concrete. Wheeling Grid-Crete is expanded from \(^3\)" thick solid steel plate, into a continuous network of 3" x 8" diamonds, weighing 6 pounds per square foot. Sheets of Grid-Crete are placed parallel to each other and to the surface for the wall, floor and ceiling. They are staggered to prevent alignment of diamonds. The result: an almost solid mass of metal to resist a straight through penetration in any direction. Wheeling Grid-Crete Security.

# Grid-Crete advantages

# Installation

This is an area where Grid-Crete offers you the most advantages over common rebar systems. Grid-Crete is available in both Modular systems for vaults of conventional design and Custom systems for special requirements. Both give you the same installation speed you are after.

Grid-Crete installs fast because huge sheets are prefabricated before they reach the site. You don't have to assemble and tie hundreds of rebars to achieve the necessary mass of metal. Actually the cost of installing a Grid-Crete System averages 50% less than an ordinary rebar system.

Each Grid-Crete System is delivered complete with installation instructions and drawings.

# Structural Strength

A Grid-Crete vault actually adds to the structural strength of the building. The pattern in Grid-Crete sheets allows concrete to key itself to all the openings in the metal, adding strength and rigidity. Grid-Crete, depending on span, is capable of supporting more than half a ton per square foot.

# **Delivery**

Modular Grid-Crete Systems are shipped from inventory, immediately upon receipt of order by vault style number.

Custom Systems are produced from fabrication drawings conforming to the dimensions required for the bank vault and are shipped promptly after engineering drawings are approved.

# The Grid-Crete System

Completely detailed erection drawings are supplied by Wheeling with every bank vault system. Following are general procedures to give you an idea of the ease and speed of installation.

- Leveling slab, if required, or floor form is placed for the floor slab.
- Position beam bolsters according to the drawings.
- Floor sheets are positioned first over beam bolsters.
- 4. 6" upper continuous high chairs are placed on the first grid sheet.
- Successive upper continuous high chairs and grids are placed as required. The grid sheets are positioned to provide a staggered condition.
- After floor grid sheets are placed, dowel bars are installed vertically in the perimeter wall areas.
- 7. Concrete is then poured to form the floor slab.
- 8. Wall grids are placed from optional points after the erection of one side of the wall form.
- Beam bolsters are secured to the sheets of the first grid and placed and positioned against the form.
- 10. Successive grid sheets are positioned and spaced with the use of 6" wall ties. The last row of grids is installed with a beam bolster between it and the wall form.
- 11. After placement of the roof slab form, the installation of roof grid sheets is performed in the same sequence as the floor grid. Positioning and installation of all grids are made in accordance with erection drawings.



Concrete pours easily and evenly through Grid-Crete's diamond pattern. Floor slab being poured.



Wall sheets are placed in staggered alignment.



Cutouts, where required, can be made at the site.



42" rebars in place to support and connect wall grid sheets.



Wall sheets are spaced and tied with 6" wall ties.



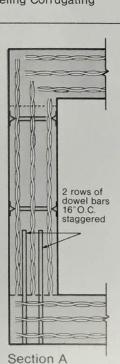
Note wall sheets are even hard to see through, let alone penetrate.

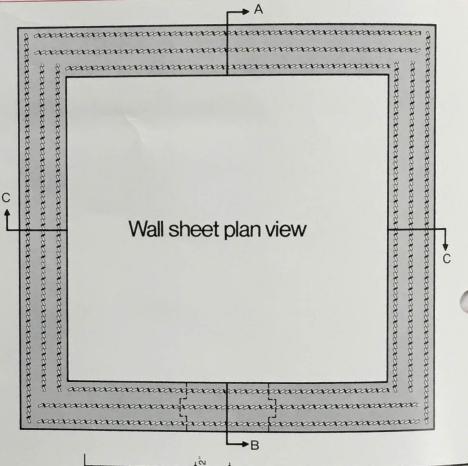
# 3 Grid System

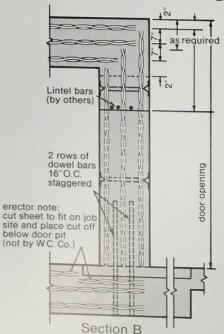
Ultimate Concrete 3000 psi Allowable Steel 20 KSI Design Moment 49 kip-ft. Slab Weight 230 psf Uniformily-applied loading—psf\* based on WL/8 Design

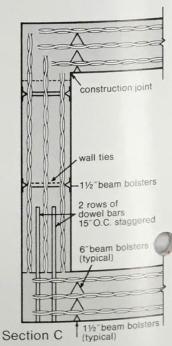
Clear	Total	Live		
Span	Load	Load		
10′0″	3960	3730		
11′0″	3273	3043		
12′0″	2750	2520		
13′0″	2343	2113		
14'0"	2021	1791		
15'0"	1760	1530		
16'0"	1547	1317		
17'0"	1370	1140		
18'0"	1222	992		
19'0"	1097	867		
20'0"	990	760		
21'0"	898	668		
22'0"	818	588		
23'0"	749	519		
24'0"	688	458		
25'0"	634	404		

\*Live loads in excess of 1250 psf not recommended. Over 25' spans, refer dimensions and load requirements to Wheeling Corrugating Company.

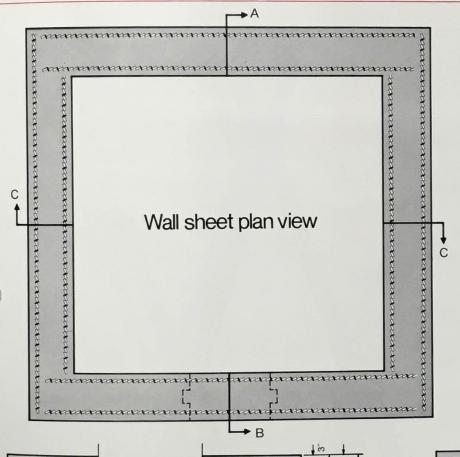








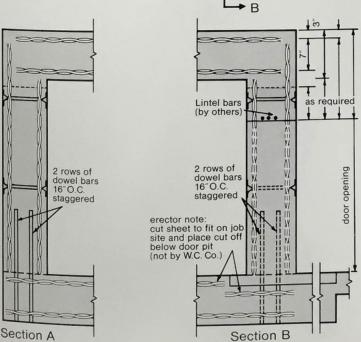
# 2 Grid System

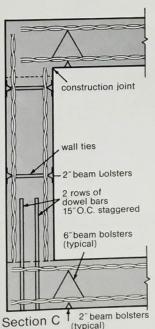


Ultimate Concrete 3000 psi Allowable Steel 20 KSI Design Moment 23 kip-ft. Slab Weight 154 psf Uniformily-applied loading—psf based on WL/8 Design

Clear Span	Total Load	Live Load		
10'0"	1841	1687		
11'0"	1521	1367		
12'0"	1306	1152		
13'0"	1089	935		
14'0"	939	785		
15'0"	818	664		
16'0"	719	565		
17'0"	637	483		
18'0"	568	414		
19'0"	510	356		
20'0"	460	306		

Over 20' spans, refer dimensions and load requirements to Wheeling Corrugating Company.





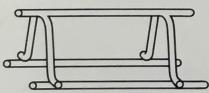
# The metal in Grid-Crete

The diamond shape of Grid-Crete sheets is machine controlled. The metal is hardened and strengthened during the expanding process. Staggered alignment of sheets presents an almost solid mass of steel to resist penetration by impact drilling or cutting.

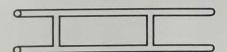
The Grid-Crete System arrives with erection drawings and procedures and the following accessories.



Beam Bolsters: 1½" (3 grid) or 2" (2 grid) bolsters for support and spacing.



6" upper continuous High Chairs for support and spacing between grids in the floor and roof.

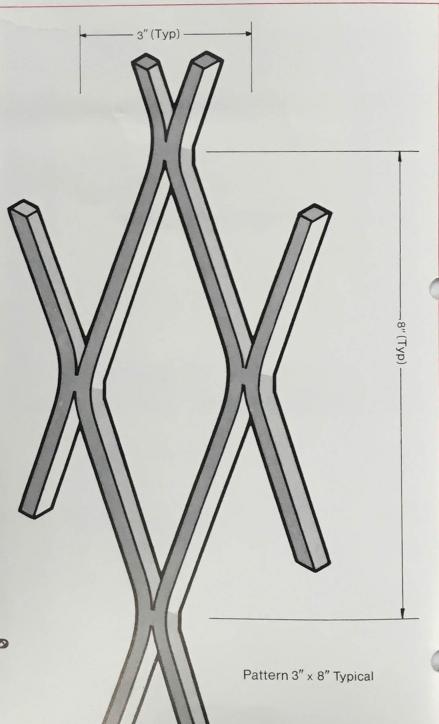


6" Wall Ties for spacing between wall grids.

## 

Rebar Dowels: 42" long for connecting floor slab with walls.

Note: All accessories except rebar dowels are 10 feet long.



# Grid-Crete Modular Systems

These systems were developed to accommodate, with minor modifications, almost any installation. Grid-Crete expanded metal sheets are fabricated, cut to standard sizes and inventoried for quick shipment.

Modular systems are offered for 24 different size vaults, for both 2 and 3 grid designs, listed below by type numbers.

Modular systems mean several savings to you.

1. Shipping from stock prevents costly con-

struction delays, allows your job to be started and completed faster. Check the size that best suits your needs.

- Installation savings are yours because panels are standard sheets that do not require special positioning. All cut outs, including final location of vault doors are done in the field, allowing for last minute changes.
- Prepared drawings save time in approvals and transmittals.

3 0	Grid System 18" Slab – 6R	& 9R
Туре	Width x Length x Height	Tonnage
3MV1-80	6'-0" x 9'-0" x 8'-0"	5.72
3MV2-80	9'-0" x 12'-0" x 8'-0"	8.00
3MV3-80	12'-0" x 15'-0" x 8'-0"	11.18
3MV4-80	15'-0" x 18'-0" x 8'-0"	14.80
3MV5-80	18'-0" x 21'-0" x 8'-0"	17.97
3MV6-80	21'-0" x 24'-0" x 8'-0"	22.37
3MV7-80	24'-0" x 27'-0" x 8'-0"	27.21
3MV8-80	27'-0" x 30'-0" x 8'-0"	31.28
3MV1-88	6'-0" x 9'-0" x 8'-8"	5.72
3MV2-88	9'-0" x 12'-0" x 8'-8"	8.00
3MV3-88	12'-0" x 15'-0" x 8'-8"	11.18
3MV4-88	15'-0" x 18'-0" x 8'-8"	14.80
3MV5-88	18'-0" x 21'-0" x 8'-8"	17.97
3MV6-88	21'-0" x 24'-0" x 8'-8"	22.37
3MV7-88	24'-0" x 27'-0" x 8'-8"	27.21
3MV8-88	27'-0" x 30'-0" x 8'-8"	31.28
3MV1-94	6'-0" x 9'-0" x 9'-4"	6.39
3MV2-94	9'-0" x 12'-0" x 9'-4"	8.89
3MV3-94	12'-0" x 15'-0" x 9'-4"	12.29
3MV4-94	15'-0" x 18'-0" x 9'-4"	16.14
3MV5-94	18'-0" x 21'-0" x 9'-4"	19.54
3MV6-94	21'-0" x 24'-0" x 9'-4"	24.15
3MV7-94	24'-0" x 27'-0" x 9'-4"	29.22
3MV8-94	27'-0" x 30'-0" x 9'-4"	33.51

2	2 Grid System 12" Slab – 5R					
Туре	Width x	L	ength	x	Height	Tonnage
2MV1-80	6'-0"	x	9'-0"	X	8'-0"	3.37
2MV2-80	9'-0"	Х	12'-0"	Х	8'-0"	5.12
2MV3-80	12'-0"	Х	15'-0"	Х	8'-0"	6.78
2MV4-80	15'-0"	X	18'-0"	Х	8'-0"	9.08
2MV5-80	18'-0"	Х	21'-0"	Х	8'-0"	11.75
2MV6-80	21'-0"	X	24'-0"	Х	8'-0"	13.95
2MV7-80	24'-0"	Х	27'-0"	Х	8'-0"	17.06
2MV8-80	27'-0"	X	30'-0"	X	8'-0"	19.06
2MV1-88	6'-0"	х	9'-0"	х	8'-8"	3.37
2MV2-88	9'-0"	х	12'-0"	Х	8'-8"	5.12
2MV3-88	12'-0"	X	15'-0"	Х	8'-8"	6.78
2MV4-88	15'-0"	X	18'-0"	Х	8'-8"	9.08
2MV5-88	18'-0"	х	21'-0"	Х	8'-8"	11.75
2MV6-88	21'-0"	Х	24'-0"	X	8'-8"	13.95
2MV7-88	24'-0"	х	27'-0"	Х	8'-8"	17.06
2MV8-88	27'-0"	х	30'-0"	X	8'-8"	19.06
2MV1-94	6'-0"	х	9'-0"	х	9'-4"	3.89
2MV2-94	9'-0"	X	12'-0"	Х	9'-4"	5.69
2MV3-94	12'-0"	x	15'-0"	Х	9'-4"	7.50
2MV4-94	15'-0"	х	18'-0"	Х	9'-4"	9.95
2MV5-94	18'-0"	X	21'-0"	Х	9'-4"	12.71
2MV6-94	21'-0"	Х	24'-0"	Х	9'-4"	15.11
2MV7-94	24'-0"	Х	27'-0"	Х	9'-4"	18.38
2MV8-94	27'-0"	X	30'-0"	X	9'-4"	21.15

# How to specify Grid-Crete Systems

# Specifications for 2 Grid System for 5R Classification and 3 Grid System for 6R and/or 9R Classification

**Scope:** This section shall include all materials, equipment and labor necessary for the installation of the concrete vault enclosure, complete, in accordance with this specification and the drawings.

Materials: The vault reinforcing grids shall consist of Wheeling Grid-Crete bank vault expanded metal, weighing 6 lb. per square foot and having 3" x 8" diamond pattern, as manufactured by Wheeling Corrugating Company, a Division of Wheeling Pittsburgh Steel Corporation, Wheeling, West Virginia. The sheets of Grid-Crete will be furnished rectangular in shape of convenient size to fit the construction.

The vault will be reinforced with (Specify Item #1 or #2):

 Two reinforcing grids placed in 12" concrete walls and slabs as described below to meet Insurance Services Office Classification 5R.

or

 Three reinforcing grids placed in 18" concrete walls and slabs as described below to meet Insurance Services Office Classification (6R or 9Rspecify which). The grids are to be placed parallel with the face of walls and slabs and located 7" apart and placed in a staggered position, using beam bolsters, wall ties or upper continuous high chairs, at spacings as shown on Wheeling erection drawings. The placing contractor will tie the expanded metal sheets to adjacent sheets, beam bolsters, and chairs as required to hold in position until concrete sets. Any necessary cutting to fit around concrete openings, etc. shall be done by the placing contractor by cutting flame or other method.

Concrete: Concrete shall conform to the ACI Standard 318-71 "Building Code Requirement for Reinforced Concrete" with maximum size aggregate of three-fourths (3/4) of an inch.

# Certified security



Wheeling provides this certificate as proof your vault meets Insurance Services Office requirements.

For 10R Rating—Ask for information on STEELCRETE Bank Vault Systems from your nearest Wheeling sales office listed on next page.

BOSTON, MASS 01801 (617) 935-5550

(716) 896-7444

CHICAGO (ITASCA), ILL. 60143 1550 Bryn Mawr Avenue (312) 773-0640

COLUMBUS, OHIO 43212\* 1100 Steelwood Road (614) 486-4318

DETROIT, MICH. 48126 6410 Miller Road (313) 584-2005

GRAND JUNC., COLO. 81501 2749 U.S. Highway 50 (303) 243-1156

MINNEAPOLIS, MINN. 55418 (612) 789-7233

NEW ORLEANS, LA. 70119 Tulane Building (504) 822-5460

N.Y./PHILA JAMESBURG, N.J. 08831 Wheeling Road N.Y. (212) 784-8580 Phila. (215) 329-1600

OAKLAND, CALIF. 94611 1880 Pleasant Valley Ave. (415) 653-8386

\*Warehouse only

ORLANDO, FLA. 32804 2515 Shader Road (305) 295-7572

RICHMOND, VA. 23224 1600 Jefferson Davis Highway (703) 232-8916

STATESVILLE, N.C. 28677\* Industrial Drive (704) 872-2471

ST. LOUIS, MISSOURI 63110 722 So. Vandeventer Avenue (314) 531-3900

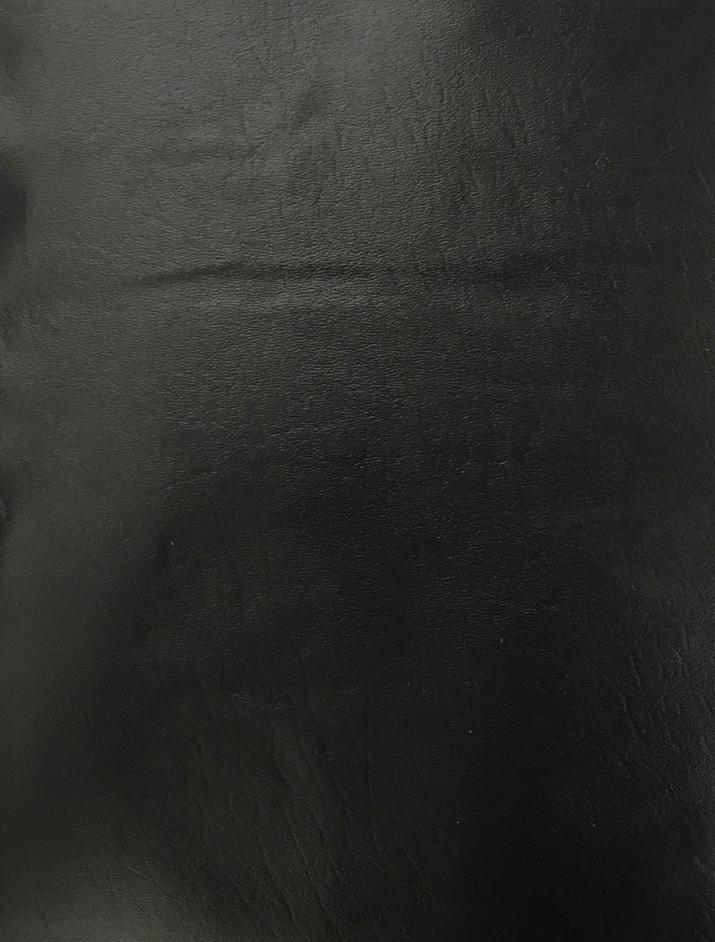
WHEELING, W. VA. 26003 1134 Market Street (304) 234-2346



A DIVISION OF WHEELING-PITTSBURGH STEEL CORPORATION

WHEELING, WEST VIRGINIA 26003

Printed in U. S. A.



# Wheeling Metal Lath & Plastering Accessories





# WHEELING METAL LATH AND PLASTERING ACCESSORIES

Wheeling Corrugating Company provides one of the most complete lines of metal lath and accessories available to the architect, builder and plastering contractor, Wheeling's unmatched metal lath products are designed to give the builder the beauty, economy, fire protection and easy-to-use features for more versatile design. For more than 60 years, Wheeling has worked closely with plasterers and builders to pioneer, develop and perfect top quality metal lath and accessories.

Various types of metal lath are manufactured by Wheeling. These include Diamond Lath, Hump Furred Lath, 3 Mesh Flat Ribbed Lath, 3%" Rib Lath, 34" Rib Lath and Stucco Binder Mesh. All are easily cut for fitting, easy to bend without rupture and easily shaped to conform to the most complex wall and ceiling designs. Wheeling Metal Lath affords the architect a wide flexibility in design, while offering the plastering contractor wide flexibility in use.

Samples of Wheeling Metal Lath and Accessories described in this catalog are available upon request. Contact the Wheeling Corrugating Company Warehouse nearest you, or write to Metal Lath Product Manager, Wheeling Corrugating Company, Wheeling, West Virginia, 26003.

Wheeling Metal Lath conforms to:
Federal Specifications QQ-L-101c
American Standard Specifications ASA-A-42
Accessories conform to:
American Standard Specifications ASA-A-42
Galvanized Tie Wire and Hanger Wire
conform to: QQ-W-461g





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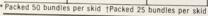
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# DIAMOND LATH

A rigid, bantam, "diamond mesh" lath, ideal for partitions, ceilings and most installations where metal lath can be used. Wheeling diamond lath offers six important advantages to the builder and architect: greater keying action, longer-lasting steel, flatness, uniform width, square ends and greater versatility in forming irregular shapes and designs.

Std. Wt. per	Finish	Sheet	Sheets	Sq. Yds.
Sq. Yd.		Size	per Bundle	per Bundle
2.5 lbs	Galvanized or	27" x 96"*	10	20
	Painted Steel	24" x 96"†	9	16
3.4 lbs	Galvanized or Painted Steel	27" x 96"*	10	20





# HUMP FURRED

A diamond expanded lath with "humps" staggered and of such depth and spacing as to hold lath 3/8" away from the wall. Lath thus furrs itself and when plastered creates effective fireproofing.

Std. Wt. per Sq. Yd.	Finish	Sheet Size	Sheets per bundle	Sq. Yds. per Bundle
2.5 lbs	Galvanized or Painted Steel	27" x 96"	5	10
3.4 lbs	Galvanized or Painted Steel	27" x 96"	5	10



# FLAT RIB

Metal lath with small openings between strands for uniform reinforcement and positive bonding of plaster. Tensile strength of lath resists tendency of plaster to crack when subjected to impact or vibration.

Std. Wt. per Sq. Yd.	Finish	Sheet Size	Sheets per Bundle	Sq. Yds. per Bundle
2.75 lbs	Painted Steel	. 27" x 96"	10	20
3.4 lbs	Galvanized or Painted Steel	27" x 96"	10	20

Packed 50 bundles per skid



### 3/8" RIB LATH

Metal lath with a fine herringbone mesh attached to stiffening ribs spaced 3%" on center and extending over entire length of sheets, provides ample rigidity for plaster bases over increased spans. Small inverted rib at outer edge permits easy lapping, thus avoiding pile up of steel and providing a uniform surface for plasterng.

Std. Wt. per Sq. Yd.	Finish	Sheet Size	Sheets per Bundle	Sq. Yds. per Bundle
3.4 lbs	Galvanized or Painted Steel	27" x 96"	10	20
4.0 lbs	Painted Steel	27" x 96"	10	20

#### Packed 50 bundles per skid

# Fast and Easy Handling with Wheeling Engineered Metal Lath Package



A factory packed skid of 500 sheets in 50, 10-sheet units—protects lath during shipment—is specifically designed for fast, easy handling and storing to save time and money.

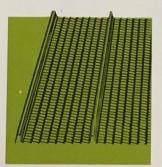


# STUCCO BINDER MESH

A lightweight, diamond mesh fabric particularly suited for stucco reinforcement. It should be applied with self furring nails to keep lath %" from the sheeting.

Std. Wt. per Sq. Yd.	Finish	Sheet Size	Sheets per Bundle	Sq. Yds. per Bundle
1.8 lbs	Galvanized Steel	48" x 96"	10	35-5/9
3.6 lbs	Galvanized Steel	48" x 96"	10	35-5/9

Packed 20 bundles per skid



#### 3/4" RIB LATH

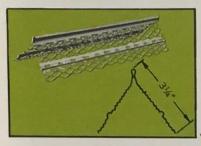
This lath is designed primarily as a reinforcement for concrete floors and roofs. It is a strong combination of expanded metal lath and ribs, with a 34" depth measured from the top inside of the lath to the top side of the rib.

Std. Wt. per Sq. Ft.	Finish	Sheet Size	Sheets per Bundle
* .60 lbs	Painted Steel	24" x 8', 10', 12'	10
* .75 lbs	Painted Steel	24" x 8', 10', 12'	10

Packed 50 bundles per skid \* Non-stock, special order

# CORNER BEADS CORNERITE AND STRIPITE

### **DOUBLE-EX CORNER BEAD**

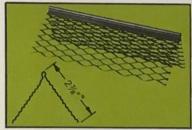


Length	Pieces per carton	Feet per carton
* 7'	30	210
8'	30	240
9'	30	270
10'	30	300
12'	30	360

Net Weight: 238 lbs per 1,000 lineal feet \* Non-stock, special order only

Full 3½" wing easily adjusted for depth of plaster on columns—highly adaptable for rough masonry on structural tile corners. A rigid straight edge as a guide. Perforated stiffening ribs in outer portion of expanded wings give greater rigidity, allow angle of the bead to be closed without expansion wings buckling in center. Extra wide wings give greater corner coverage. Excellent "keying" areas extend to the round, die-straight nose of the bead. 26 ga. galvanized, also available in zinc alloy.

#### NO. 1 EXPANDED CORNER BEAD

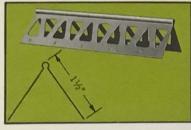


Length	Pieces per carton	Feet per carton
* 7'	30	210
8'	30	240
9'	30	270
10'	30	300
12'	30	360

Net Weight: 202 lbs per 1,000 lineal feet \*Non-stock, special order only

Flexible, easy to erect over uneven corners. Mesh anchors it securely—provides reinforcement for adjoining plaster. 2½" Flange. 26 ga. galvanized, also available in zinc alloy. 40 cartons per skid

#### **FLEX BEAD**



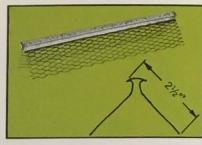
Length (ft.)	Pieces per carton	Feet per carton
* 7'	80	560
* 8'	80	640
* 9'	60	540
* 10'	60	600
* 12'	60	720

Net Weight: 150 lbs per 1,000 lineal feet \* Non-stock, special order only

Provides protection for the exposed plastered corner and makes a rigid straight edge as a guide for workmen, thus greatly simplifying his job. Ideal for arches because of its extreme flexibility. 1½" Flange. 26 ga. galvanized.

36 cartons per skid

# NO. 10 BULL NOSE CORNER BEAD

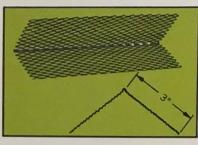


Length	Pieces per carton	Feet per carton
* 7'	30	210
8'	30	240
9'	30	270
10'	30	300
* 12'	30	360

Net Weight: 320 lbs per 1,000 lineal feet \*Non-stock, special order only.

Expanded flange. Used for all types of construction, especially good for schools, office buildings, hospitals, etc. Broad, round nose gives extra resistance against corner damage. Nose width is 1", radius is 34". 2½" Expanded Flange. 26 ga. galvanized, steel. Also available in zinc alloy.

## **EX-STRAND CORNERITE**



Sizes (inches)	Pieces per carton	Feet per carton
2" x 2" x 96"	75	600
3" x 3" x 96"	75	600

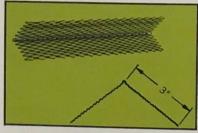
Net Weight:  $(2" \times 2")$  85 lbs per 1,000 lineal feet.  $(3" \times 3")$  128 lbs per 1,000 lineal feet

The sure way to get permanent, crack-resistant corners. Easier, safer to use. Double corner strand prevents buckling, provides firm plaster anchorage. Smooth true edges. Formed to a greater than 90° angle to fit snugly into corners. Available in painted or \*galvanized steel.

(2" x 2") 50 cartons per skid (3" x 3") 24 cartons per skid

\* Galvanized, special order only

# SINGLE STRAND CORNERITE



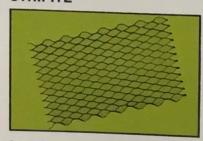
Sizes (inches)	Pieces per carton	Feet per carton
2" x 2" x 96"	75	600
3" x 3" x 96"	75	600

Net Weight: (2" x 2") 85 lbs per 1,000 lineal feet. (3" x 3") 128 lbs per 1,000 lineal feet

Used to reinforce interior corners, vertical or horizontal, over gypsum lath. Also used at all interior corners where different plaster bases meet. Elimination of rough edges speeds plastering. Available in painted steel.

(2" x 2") 50 cartons per skid (3" x 3") 24 cartons per skid

## STRIPITE



Sizes (inches)	Pieces per carton	Feet per carton
4" x 96"	75	600
6" x 96"	75	600

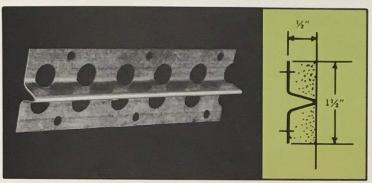
Net Weight: (4") 85 lbs per 1,000 lineal feet. (6") 128 lbs per 1,000 lineal feet

Smooth edge strip lath is used to cover sections of the wall and ceiling where joints might cause plaster to crack. Also around window and door frames where metal lath is not used as a plaster base. Available in painted or \* galvanized steel.

40 cartons per skid \* Galvanized, special order only

# BASE SCREEDS PICTURE MOULD

# NO. 77 STRAIGHT POINT BASE SCREED



The most popular type of base grounds. Provides a neat dividing strip for use in separating the wall plaster and flush cement or composition base. 26 ga. galvanized steel.

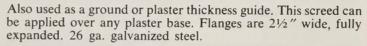
Length	Pieces per carton	Lineal feet per carton
* 10'	50	500

Net Weight: 160 lbs per 1,000 feet

Non-stock, special order only

1/2" grounds

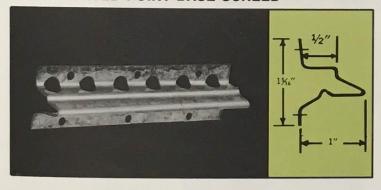
NO. 3 EXPANDED BASE SCREED



Length	Pieces per carton	Lineal feet per carton
*10'	50	500

Net Weight: 200 lbs per 1,000 feet \* Non-stock, special order only 1/2" grounds

## NO. 74 CURVED POINT BASE SCREED



Recommended where thickness of cement base and plaster wall vary. Offset above the curve acts as a ground for plaster and point of curved nose acts as a ground for base. Nose forms permanent cap for cement, terrazzo or composition base. 26 ga. galvanized steel.

Length	Pieces per carton	Lineal feet per carton
* 10'	50	500

Net Weight: 175 lbs per 1,000 feet
\* Non-stock, special order only

1/2" grounds

## NO. 70 CONCEALED PICTURE MOLD



Used as a support for pictures or maps, is generally applied around the entire perimeter of the room. It is attached directly to the lath, leaving a narrow line between flanges for picture hooks. 26 ga. galvanized steel.

Length	Pieces per carton	Lineal feet per carton
* 10′	50	500

Net Weight: 202 lbs per 1,000 feet

\* Non-stock, special order only

# CASING BEAD

These die-straight, carefully designed accessories serve as trim for doors and windows, as well as for uniform screeds. They are fabricated from rugged and rust resistant 24 gage Wheeling SofTite Galvanized steel. Casing beads eliminate painting of wood trim and provide a smooth, uncluttered appearance around doors and windows. The finished wall does not have protruding trim, making a small room look larger. They are popular for both modern and traditional design. Wheeling offers three basic styles which include: quarter round; semi-square and square. Casings are available with short solid flange or with expansion wing for greater plaster reinforcement. The lengths are 7' and 10'. Also available in zinc alloy.

# "QUICK SPLICE" CASING BEAD

#66SS (Short Flange) 4/2", 5%" or 3/4" Grounds



20 splices included in each carton. Weights same as #66 regular Casing Bead.

Pieces per Carton

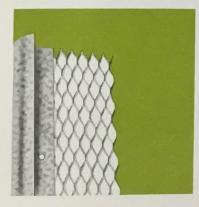
7′	10'	
40	30	

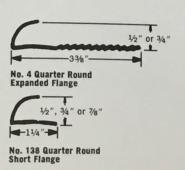
# Wheeling "Quick Splice" clip



With the use of a Wheeling "Quick Splice" clip, Wheeling's "Quick Splice" Casing Bead can be joined quickly and accurately with a minimum of effort. This eliminates alignment problems; replaces complicated splicing methods and cuts down on waste (drop-offs can be spliced and used).

### QUARTER ROUND CASING BEAD

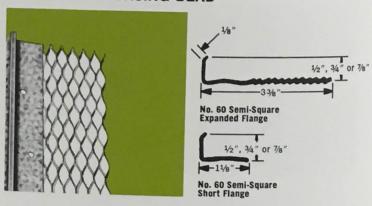




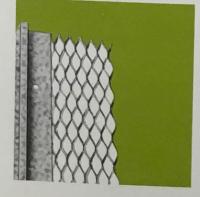
		Weight per 1,000 lineal feet	
No.	Size	Expanded	Short Flange
	* 1/2"	_	200 lbs
138	* 3/4"	_	240 lbs
	* 7/8"	_	250 lbs
4	* 1/2"	260 lbs	_
	* 3/4"	300 lbs	_
	* 1/2"	230 lbs	160 lbs
60	* 3/4"	260 lbs	180 lbs
	* 7/8"	270 lbs	190 lbs
	* 3/8"	230 lbs	160 lbs
	1/2"	250 lbs	170 lbs
	5/8"	260 lbs	180 lbs
66	3/4"	270 lbs	200 lbs
00	7/8"	280 lbs	210 lbs
	1"	290 lbs	220 lbs
	*11/8"	310 lbs	230 lbs
	*11/4"	320 lbs	250 lbs

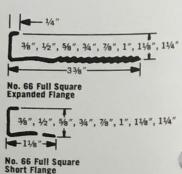
Stocked in 7' and 10' lengths. 7' containing 40 piecs per carton, 10' containing 30 pieces per carton.

# SEMI-SQUARE CASING BEAD



# SQUARE CASING BEAD

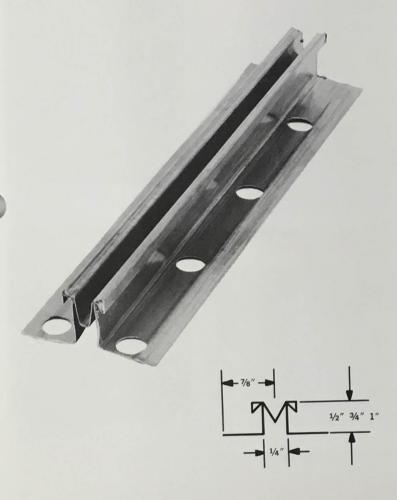




<sup>\*</sup>Non-stock, special order only.

# EXPANSION JOINTS AND CONTROL JOINTS

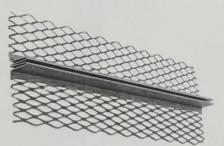
Control Joint is designed to relieve stresses of both expansion and contraction in large plastered areas. Made from roll-formed zinc, it is resistant to corrosion in both interior and exterior uses with gypsum or portland cement plaster. An open slot, ½" wide and ½" deep, is protected with plastic tape which is removed after plastering is completed. The short flanges are perforated for keying and attachment by wire-tying to metal lath or by stapling to gypsum lath. Thus the plaster is key-locked to the control point, which not only provides plastering grounds but can also be used to create decorative panel designs. Sizes and grounds: No. 50, ½"; No. 75, ¾"; No. 100, 1" (for uses such as exterior stucco, acoustical plaster and radiant heat plaster).



Size	Pieces per Carton	Net Wt. per 1,000 Ft		
* #50 —1/2"	25	184		
* #75 —3/4"	25	204		
* #100—1"	25	204		

Lengths: 8'2" and 10'

## **NO. 15 EXPANSION JOINT**



Designed to relieve stresses and strains and to minimize cracking in large gypsum plaster and cement plaster areas. Also, provides ground to assure proper plaster or stucco thickness. Expanded flange made of 26 gage Galvanized steel. Also available in zinc alloy.

Grounds	Length	Pieces per carton	Net Wt. per 1,000 ft.
1/2"	10	24	293
3/4"	10	24	359
* 7/8"	10	24	397
* 1"	10	24	397
* 11/8"	10	24	397
* 11/4"	10	24	397

\* Non-stock, special order only

# **NO. 30 EXPANSION JOINT**





A one-piece joint for inside corners designed to expand and contract with the movement of plastered walls and ceilings. Made of 26 gage Galvanized steel. Zinc alloy on special order.

Grounds	Length	Pieces per carton	1,000 ft.	
* 1/2"	10	24	293	
* 3/4"	10	24	359	
* 7/8"	10	24	397	

\* Non-stock, special order only

# NO. 40 EXPANSION JOINT



Made in two sections, the No. 40 Expansion Joint can be adjusted from 1/8" to 5/8". Made in 26 gage Galvanized steel. Also available in zinc alloy.

Grounds	Length	Pieces per carton	Net Wt. per 1,000 feet
1/2"	10	15	477
3/4"	10	15	515
* 7/8"	10	15	533
* 1"	10	15	552
* 11/4"	10	15	590

<sup>\*</sup> Non-stock, special order only

<sup>\*</sup> Non-stock, special order only

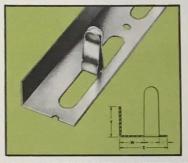
# FLOOR AND CEILING RUNNERS

## PRONGED RUNNER #150

A fast and easy method of attaching 34" channel studs. Can also be used as a floor runner where metal base is not specified. 20 gage Galvanized steel.



Length	Pieces per carton	Wt. per 1,000 feet
10'	10	197 lbs

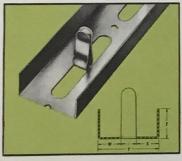


## FLOOR RUNNER #151

Simplifies erection of hollow partitions using stud widths from 2" to 6". Prongs are 4" apart for stud spacings of 12", 16" or 24". Available in two grounds — 1" flange and ½" flange. Made from 20 gage galvanized steel; in 10' lengths and supplied 10 pieces per bundle.

Туре	Partition	W	X	Υ	Wt., 1000 Ft.
* No. 151A	Metal Lath	13/16"	1%6"	1"	353
* No. 151B	Gypsum Lath	15/16"	111/16"	1"	370
* No. 151C	Metal Lath	13/16"	1%6"	1/2"	284
* No. 151D	Gypsum Lath	75/6"	111/16"	1/2"	301

\* Non-stock, special order only



# FLOOR RUNNER

#152

Combination runner, base and screed for thin-wall solid partitions. Prongs on 4" centers assure accurate spacing for 34" channel studs. Flanges are 1" or 16" as desired. Made from 20 gage galvanized steel in 10' lengths and supplied 10 pieces per bundle.

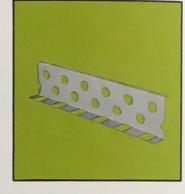
Туре	Partition	W	Х	Y	Z	Wt., 1000 Ft
* No. 152A	Metal Lath	3/4"	3/4"	2"	1"	552
* No. 152B	Metal Lath	7/8"	7/8"	2½"	1"	587
* No. 152C	Metal Lath	3/4"	3/4"	2"	%6"	362
* No. 152D	Metal Lath	7/8"	7/8"	2½"	%6"	397

\* Non-stock, special order only

# CEILING "Z" RUNNER (Style CZ-25) \*

Small flange has  $\frac{3}{32}$  x  $\frac{5}{8}$ " slotted holes for attaching to ceiling with stub nails or rawl drives. Lower flange has rectangular holes on 2" centers to receive  $\frac{3}{4}$ " channels. Made from 26 gage galvanized steel, furnished in 10' lengths. Supplied 50 lengths to the bundle and 25 bundles per skid. 220 lbs per 1,000 feet.

\* Non-stock, special order only



# CEILING "L" RUNNER (Style CL-25) \*

Used for studless partitions, lath ties directly to this runner. Can also be used as floor runner where metal base is eliminated. \( \frac{5}{8}'' \) leg has nail holes 2" on center. Vertical leg is \( \frac{1}{2}\frac{1}{2}'' \) with elongated holes for keying of plaster. Made of 26 gage galvanized steel, supplied in 10' lengths. Supplied 50 lengths to the bundle and 40 bundles per skid. 141 lbs. per 1,000 feet.

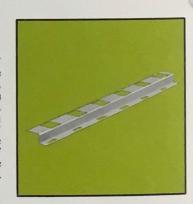
\* Non-stock, special order only



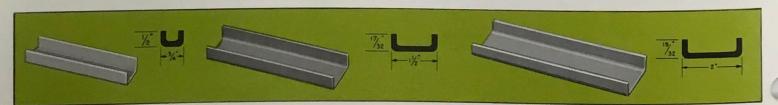
# FLOOR "Z" RUNNER (Style FZ-58) \*

Attached to floor to support ¾" channel studs where metal base and clips are not specified. Bottom leg has ¾2" x 5%" slotted holes on 2" centers for nailing to floor. Other leg has rectangular holes on 2" centers to accommodate ¾" channel studs. Made from 26 gage galvanized steel, supplied in 10' lengths. Supplied 50 lengths to the bundle and 40 bundles per skid. 118 lbs per 1,000 feet.

\* Non-stock, special order only



# **COLD FORMED CHANNELS**



Widths	Lengths	Weight per 1 Painted	,000 Lineal Feet Galvanized	Pieces per Bundle	Bundles per Lift	
3/4"	16' and 20'	300	322	20	40	
11/2"	16' and 20'	475	526	10	45	
2"	16' and 20'	600	664	10	36	

Accurately formed from 16 gage carbon steel, Wheeling Cold Formed Channels are rigid and provide for excellent workmanship. They are furnished painted or cut from SofTite galvanized steel.

# **BAR Z SHOE**



Used for holding studs in place after the studs are positioned inside the track.

Size	per	Net Weight per 1,000 feet		
5"	200	70		
8"	200	110		



BAR Z STUDS 18 gage cold formed painted steel studs having alternately opposed triangle openings in the web. Standard lengths of 8, 10, 12, 14, 16, 18, and 20 feet. Special lengths available on applica-

Size	Pieces per Bundle	Net Weight per 1,000 feet
15/8"	10	240
21/2"	10	369
31/4"	10	350
4"	10	464
6"	10	620

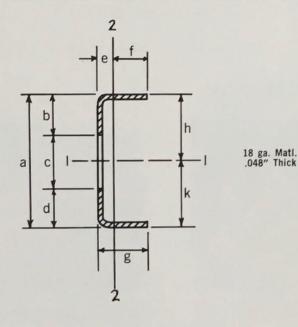
#### BAR Z TRACK



An excellent floor and ceiling track for hollow partition construction. 18 gage painted steel in standard lengths of 10 feet.

Size	Pieces per Bundle	Net Weight per 1,000 feet
15/8"	10	240
21/2"	10	369
31/4"	10	350
4"	10	464
6"	10	620

# **DIMENSIONS AND PROPERTIES OF BAR-Z STUDS**



# DIMENSIONS

Size	"a"	"b"	"c"	"d"	"e"	"f"	"g"	"h"	"k"
21/2"	2.438"	.594"	1.250"	.594"	.126"	.343"	.469"	1.219"	1.219"
31/4"	3.188"	.469"	2.250"	.469"	.145"	.355″	.500″	1.594"	1.594"
4"	3.938"	.844"	2.250"	.844"	.112"	.388″	.500"	1.969"	1.969"
6"	6.104"	.813"	4.479"	.813"	.219"	.571"	.790"	3.052"	3.052"

## PROPERTIES

Size	Moment of Inertia 1-1 (in4)	Section Modulus 1-1 (in³)	Radius of Gyration 1-1 (in)	Area (in²)	Moment of Inertia 2-2 (in4)	Section Modulus 2-2 (in³)	Radius of Gyration 2-2 (in)
21/2"	.1017	.0834	1.041	.899	.0019	.0054	.1414
31/4"	.1806	.1132	1.464	.809	.0022	.0061	.1562
4"	.3468	.1761	1.698	1.168	.0025	.0064	.1413
6"	1.1650	.3817	2.835	1.415	.0089	.0156	.2480

# BAR Z STAGGERED STUD CLIP



A galvanized clip used with 3½" or 4" snap-in track and 2½" Bar Z Studs to speed construction of the Staggered Stud Partitions.

Pieces per carton	Net Wt. per 1000 pcs.
* 500	30 lbs

<sup>\*</sup> Non-stock, special order only

# GALVANIZED SNAP-IN TRACK

Eliminates the need for shoes and troublesome shoe tying because of the exclusive design. A full 11/8" deep, this track has die-formed slots every two inches. This makes it possible to swiftly and securely install studs merely by placing them at the proper position on the track and snapping them into place with an easy twisting motion. And be-cause the track is clearly marked, you position studs without constant measuring. Made from 22 gage galvanized steel.



Size	Length	Pieces per Bundle	Weight per 1000 Feet	Bundles per Lift
2½"	10'	10	449	27
3¼"	10'	10	458	21
4"	10'	10	546	18

# WIRE, CLIPS AND NAILS

# CLIPS FOR GYPSUM LATH

## JX Clip

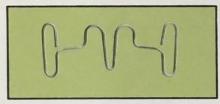
Field clip attaches 3/8" or 1/2" gypsum lath to Wheeling's Bar Z studs and CR channel studs.



Pieces per carton	Weight per carton
* 1,000	16 lbs

\* Non-stock, special order only

# C Clip Bridge, Field and Resilient



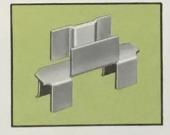
C-1—Nailed to wood studs provides excellent resilient construction. Same clip used as bridge clip to connect 3%" or 1½" joining gypsum lath sheets. Also used as field clip to attach lath to welded wire studs.

C-2—Same as Type C-1 except for  $\frac{1}{2}$ " or  $\frac{5}{8}$ " thickness lath.

Pieces per carton	Weight per carton
* 1.000	25 lbs

\* Non-stock, special order only

# DUO-DUTY CLIP

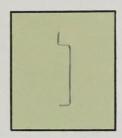


Serves two purposes—for attachment of 3/8" gypsum lath to 3/4", 11/2" and 2" cold rolled channels and Bar Z studs; also for connecting sheets of 3/8" gypsum lath.

Pieces per carton	Weight per carton
500	34

## JF Clip

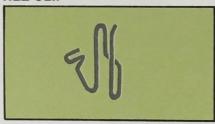
Finishing clip eliminates wire tying by engaging track at ceiling, locking top course of lath in place.



Pieces per carton	Weight per carton
* 1,000	11 lbs

\* Non-stock, special order only

# **REZ CLIP**



The most economical attachment for 3/8" lath directly to Wheeling's Bar Z studs for Resilient Wall Construction.

Pieces per carton	Weight per carton
* 1,000	22 lbs

\* Non-stock, special order only

## SF Starter-Finisher Clip



Drives under partition track. Starts initial course of lath and finishes at ceiling line.

Pieces per carton	Weight per carton
500	7

## BCR Clip Drive-in Resilient Starter-Finisher



Drives under partition track. Maintains resilience of starting and finishing of lath.

Pieces per carton	Weight per carton	
* 500	12	

\* Non-stock, special order only

# TIE AND HANGER WIRE (Straightened and Cut or Coiled)





This wire is annealed for strength and galvanized for long life.

Gage	Decimal Thickness	Feet per pound
8	.162	14.3
9	.1483	17.1

Catchweight Coils—50 lb Straightened and Cut (12')—100 lb Bundles

#### HANK TIE WIRE



Quality zinc coated tie wire possesses unusual strength, yet is soft and easy to handle. Packed in a specially designed carton. The wire is bent Ushaped, and the whole hank enclosed in a special carton to keep the wire clean and dry. Wrapping is arranged so that the carton may be opened at one end and a handful of wire withdrawn without unwrapping the entire package. Each carton of Hank wires weighs 25 lbs. and contains approximately 1,000 pieces. 48" long and available in 16 and 18 gage.



Gage	Decimal Thickness	Feet per pound
16	.0625	96.0
18	.0475	166.2

Catchweight Coils—50 lb Straightened and Cut (30")—25 lb Bundles

#### STUB NAILS



Made of a special hard steel. Ideal for nailing track to concrete floors or fastening corner bead and lath where they lap over brick, tile or concrete. Available in bags and 25-lb. cartons (not bagged).

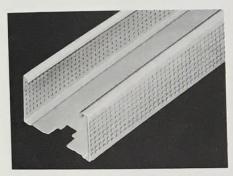
Length	No. per bag	Wt. per bag
1/2"	2,000	6 lbs
5/8"	2,000	8 lbs
3/4"	1,000	4 lbs
1"	1,000	7 lbs

# DRY WALL TRACK AND STUDS

By using Wheeling Dry Wall Track and Studs for dry wall installations, you are assured of a fast, economical and durable installation. The track and studs are the only elements needed to form a base for the gypsum lath. Studs are easily

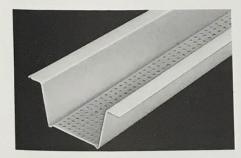
installed, set them in the track and twist into place. Shoes, wire tying and clips are un-needed. Cost savings are realized in both labor and materials.

# DRY WALL



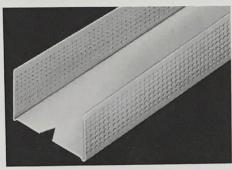
DW and CW Studs formed from hotdipped galvanized steel, available in 25, 20 and 18 gage. There are wide flanges for screw attachment of collateral material as well as convenient openings for wire and conduit installation. Custom lengths available 6' minimum to 24' maximum.

# DRY WALL 7/8" FURRING RUNNER



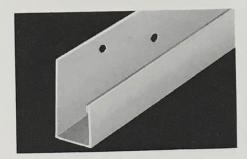
Furring Channels are made of hot-dipped galvanized steel, with a knurled web and hemmed edge. It's designed for screw attachment of collateral material. The wings are knurled and ½" wide for easy attachment to all types of masonry walls or suspended support members. Furring channels are available in standard lengths of 12'.

# DRY WALL



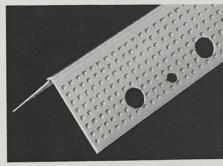
Track for Studs is made of hot-dipped galvanized steel. This component is designed for floor or ceiling application, and is available in standard lengths of 10', in 25, 20 and 18 gage.

# DRY WALL J-BEAD



J-Beads serve as square nose metal trim for protection around wall openings, windows and doors, and for use as mouldings. They are available for use with 3/8", 1/2" and 5/8" wallboard. Standard lengths: 8' and 10'.

# DRY WALL V-BEAD



V-Beads are for protecting external corners and provide proper grounds and screed for the cement compound. Standard lengths: 8' and 10'.

For information on our Drywall Products, contact our sales office (listed on the back) closest to you.

# OTHER JILDING MATERIAL PRODUCTS

#### **GALVANIZED ZIGZAG** WALL TIES



The high quality steel used in these Wall Ties and their excellent design make them longer lasting and easier to work with. They are punched with nail holes making them suitable for either brick veneer or solid brick construction.

Size	Packaged	Net Weight
7/8" x 7"	Cartons of 1,000	27 lbs

# **ASHPIT** AND **CLEANOUT** DOORS



One of the sturdiest doors of its kind. It has the desired dimensions. It will stand up for the life of the building though low in cost. Packed 6 per carton.

Size	Shipping Wt. per 100 pieces	Opening Dimensions
8" x 8"	290 lbs	73/8" x 73/8"

#### WALL **PLUGS**



They are the best choice for building job because they are constructed from Wheeling Galvanized SofTite steel and designed with corrugations that hold nails in a tight grip. The sides are closed to prevent entry of wet mortar.

Size	Packaged	Net Weight
2½" x 2¼"	Cartons of 500	43 lbs

# **MORTAR** AND **BRICK HODS**



	Mortar Hods	Brick Hods
Dimensions	11" x 11" x 22" (inside)	7" x 7" x 21½"
Shipping Wt. per each	11 lbs	81/2
Packaging	3 per bundle	4 per bundle

**GALVANIZED WINDOW WELLS** 

Both the Round and Straight type Window Wells are made from galvanized corrugated steel sheets. They are top rolled to provide a smooth, rigid appearance. Edges are turned and  $\frac{5}{16}$ " holes are provided for fastening. Available in 12", 18", 24", 30" and 36" heights.

#### SALES OFFICES AND WAREHOUSES

ATLANTA, GA. 30340 De Kalb Bldg.—North Park 2801 Clearview Place, N.E. (404) 458-0093

BOSTON, MASS, 01801 10 Wheeling Ave. (617) 935-5550

**BUFFALO, N.Y. 14225** 1722 Walden Ave. (716) 896-7444

CHICAGO, (ITASCA), ILL. 60143 1550 Bryn Mawr Ave. (312) 773-0640

COLUMBUS, OHIO\* 43212 1100 Steelwood Rd. (614) 486-4318

DETROIT, MICH. 48126

6410 Miller Road (313) 584-2005

GRAND JUNC., COLO.\* 81501 2749 U.S. Highway 50 (303) 243-1156

HOUSTON, TEXAS 77027 5050 Westheimer Bldg. (713) 622-0040

KANSAS CITY (LENEXA), KAN. 66215 9801 Alden Road (913) 888-4900

LOUISVILLE, KY. 40210 1424 S. 15th Street (502) 634-0541

MINNEAPOLIS, MINN, 55418 340 27th Ave., N.E. (612) 789-7233

NEW ORLEANS, LA. 70119 Tulane Bldg. (504) 822-5460

NEW YORK, N.Y. (212) 784-8580 Jamesburg, N.J., Wheeling Rd. 08831 Phone (609) 655-3553

OAKLAND, CALIF. 94611 1880 Pleasant Valley Ave. (415) 653-8386

PHILADELPHIA, PA. (215) 329-1600 Jamesburg, N.J., Wheeling Rd. 08831 Phone (609) 655-3553

RICHMOND, VA. 23224

1600 Jefferson Davis Hwy. (703) 232-8916

STATESVILLE, N.C. \* 23677 Industrial Drive (704) 872-2471

ST. LOUIS, MO. 63110 722 S. Vandeventer Ave. (314) 531-3900

TAMPA, FLA. \* 33619 1801 Massaro Ave. (813) 621-3461

WHEELING, W.VA. 26003 1134 Market Street (304) 234-2346

\*Warehouse only

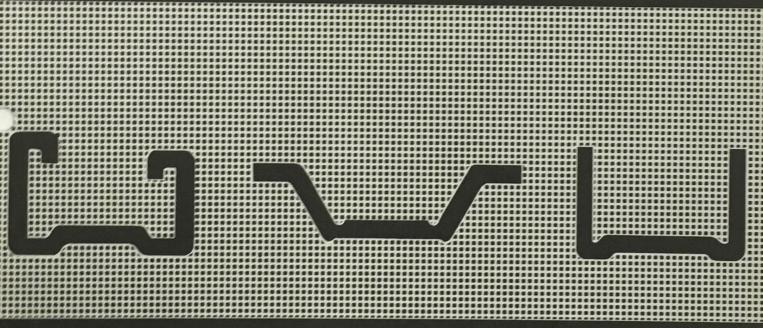
# **Wheeling Corrugating Company**

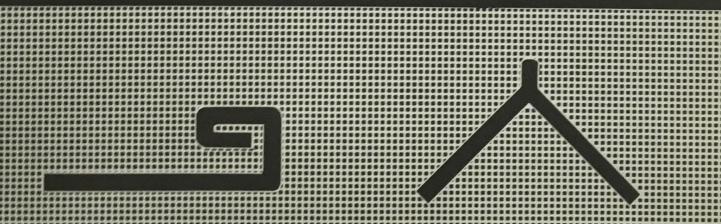
A DIVISION OF WHEELING-PITTSBURGH STEEL CORPORATION Wheeling, West Virginia

# Wheeling Steel Stud and Furring System

For installing Curtain Walls · Dry Wall
· Lath and Plaster · Thin Coat







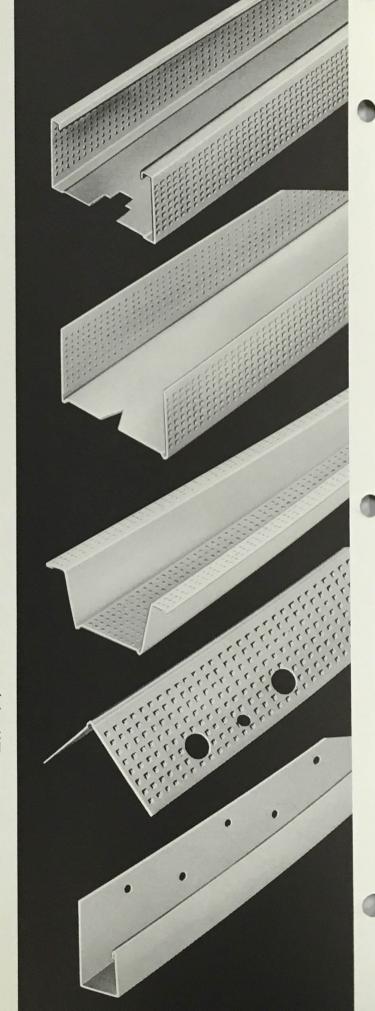
DW and CW Studs of the non-load bearing channel type are made of hot-dipped galvanized steel and have telescoping design for self-splicing. There are wide flanges for screw attachment of collateral material as well as convenient openings for wire and conduit installation. Custom lengths available 6' minimum to 24' maximum.

Floor and Ceiling Track for Studs are made of hotdipped galvanized steel. This component is designed for floor or ceiling application, and is available in standard lengths of 12'.

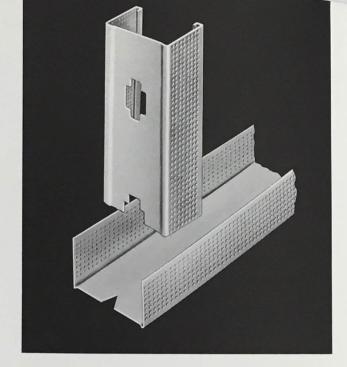
Furring Channels are made of hot-dipped galvanized steel, with a knurled web and hemmed edge. It's designed for screw attachment of collateral material. The wings are knurled and ½" wide for easy attachment to all types of masonry walls or suspended support members. Furring channels are available in standard lengths of 12'.

V-Beads are for protecting external corners and provide proper grounds and screed for the cement compound. They are made of electro-galvanized steel, and are knurled. Four flange sizes provide low cost material for standard job requirements. Standard lengths 7', 8' and 10'.

J-Beads serve as square nose metal trim for protection around wall openings, windows and doors, and for use as mouldings. They are available for use with \%", \\\'2" and \\%" wallboard. Standard lengths 7', 8' and 10'.



# Wheeling Steel Stud and **Furring System**



The Wheeling Steel Stud and Furring System has been designed to make your job more profitable and efficient. As you can see from the data in this brochure, it is a simple, yet highly effective way to install walls and ceilings. It utilizes five advanced design features:

## SYSTEM FEATURES

The Wheeling system is a lightweight system of galvanized steel framing for walls and ceilings. Every feature that speeds or facilitates application and assures maximum quality has been included . . .

- FORMED FROM GALVANIZED STEEL. All Wheeling studs, track and furring channels are made of controlled hot-dipped galvanized steel. It is not electro-galvanized or painted.
- ALL STUD SIZE REQUIREMENTS. Wheeling studs come in 1%", 21/2", 31/4", 35/8" and 4" sizes. With Wheeling you can call on one source for all job requirements.

- KNURLED TRACK LEG SURFACES. Wheeling furnishes 1" and 13/6" leg heights for drywall track. Both types have the leg surface knurled for easy screw alignment and penetration.
- ACCURATE TRACK ALIGNMENT. Wheeling track is furnished with a half diamond notch at each end, and a full diamond notch 12" from each end. The installer can strike one (1) line at the center of the partition and align the track with the diamond notches.
- LARGE KNURLING. This provides a guide for positive screw alignment. Screws penetrate straighter, easier and hold tighter. Besides cutting installation costs, you reduce material costs because larger knurls permit the use of less expensive attachment screws.

# **TECHNICAL DATA**

Physical and Structural Properties of Non Load-Bearing Studs.

DRY WALL STUDS®\_(t = 0.0209") Base Metal Thickness (25 gage)

Tuna	Size	Weight	Net Area		About X-Axis		About	
Туре	(ln.)	Lb./Ft.	In.2	lx In. 4 ①	Sx In.3	Rx In. 3	ly In. 4 ①	Ry In. 3
A	15/8	0.3370	0.0822	0.04536	0.04818	0.6887	0.02023	0.5137
В	21/2	0.3943	0.0861	0.11970	0.08085	1.0267	0.02181	0.5098
С	35/8	0.4762	0.1097	0.28100	0.13825	1.4341	0.02888	0.4947
D	4	0.5035	0.1175	0.35362	0.15925	1.5653	0.03061	0.4888

DRY WALL STUDS $^{\circ}$ —(t = 0.0359") Base Metal Thickness (20 gage)

	0!	Weight	Net Area		About X-Axis		About	Y-Axis
Туре	Size (In.)	Lb./Ft.	In.2	Ix In. 4 ①	Sx In.3	Rx In. 3	ly In. 4 ①	Ry In. 3
D		0.6735	0.1469	0.21108	0.15178	1.0197	0.03728	0.5109
D	21/2		0.4070	0.49570	0.25629	1,4272		
C	35/8	0.8142	0.1873			1.4212	0.04954	0.4957
D	4	0.8612	0.2007	0.62353	0.29430	1.5581	0.05252	0.4897

The Values of "I" were determined for Deflection Calculations.

The Sectional Properties were computed on the basis of Fy  $\equiv$  33 Ksi

<sup>3</sup> Radius of Gyration Shown is based on Gross Unreduced Section.

# Allowable Non-Load Bearing Partition Heights Based on Stud Properties only for 0.0209-inch and 0.0359-inch Galvanized Studs.

D. O. alian	Stud			Stud Depth	and Thicknes	s (in inches)		
Deflection Limitation	Spacing (in inches)		t = 0	.02095			t = 0.03595	
	(iii iiiches)	15/8	21/2	35/8	4	21/2	35/8	4
h/240 (Brittle)	12 16 24	8'-5" 7'-7" 6'-8"	11'-7" 10'-6" 9'-2"	15'-5" 14'-0" 12'-3"	16'-8" 15'-1" 13'-2"	14'-0" 12'-9" 11'-2"	18'-8" 17'-0" 14'-10"	20'-2" 18'-4" 16'-0"
h/120 (Flexible)	12 16 24	10'-7" 9'-7" 8'-5"	14'-7" 13'-3" 11'-7"	19'-5" 17'-8" 15'-4"	20'-0" 19'-0" 16'-9"	17'-8" 16'-1" 14'-0"	23'-6" 21'-4" 18'-8"	25'-5" 23'-0" 20'-2"

- The tabulated partition heights are based on the Steel Stud Section Properties only to conform to the load and deflection criteria specified in Section 2312 (b) of the Uniform Building Code, latest adoption.
- 2. Other criteria is as follows:
  - a) Shear Stress in Webs:
    For h/t not greater than 547 / √ fy:
    Fv = 152 √ fy with a maximum
    h/t of 0.40 fy

    For h/t greater than 547 / √ fy:
    Fv = 83,200

(h/t)2

- b) Bending Stress in Webs Fbw = 520,000  $(h/t)^{2}$
- 3. To determine "h/t", Web Cutouts are neglected.
- Maximum Steel Bending Stress 26.6 KSI Includes allowable increase due to wind or earthquake.
- 5. Base Metal Thickness.

# Allowable Non-Load Bearing Exterior Wall Heights Based on Stud Properties only for 0.0209-inch and 0.0359-inch Galvanized Studs.

		Stud Depth and Thickness (in Inches)												
Wind Pressure	t = 0.0209 = 25 Ga.							t = 0.0359 = 20 Ga.						
	1	5/8	21	1/2	3	5/8	4	l .	2	1/2	3	5/8		4
12" O.C.	L/120	L/240	L/120	L/240	L/120	L/240	L/120	L/240	L/120	L/240	L/120	L/240	L/120	L/240
15 PSF	7'-4"	5'-10"	9'-10"	8'-1"	12'-10"	10'-8"	13'-9"	11'-7"	12'-4"	9'-8"	16'-4"	12'-11"	17'-7"	14'-0"
20 PSF	6'-6"	5'-4"	8'-6"	7'-4"	11'-1"	9'-8"	11'-11"	10'-6"	11'-1"	8'-9"	14'-9"	11'-9"	16'-0"	12'-8"
25 PSF	5'-10"	4'-10"	7'-7"	6'-9"	9′-10″	9'-0"	10'-7"	9'-10"	10'-4"	8'-2"	13'-6"	10'-10"	14'-6"	11'-9"
30 PSF	5'-4"	4'-7"	6'-10"	6'-5"	9'-0"	8'-6"	9'-8"	9'-1"	9'-6"	7'-8"	12'-4"	10'-4"	13'-2"	11'-0"
35 PSF	4'-10"	4'-5"	6'-5"	6'-0"	8'-5"	8'-0"	9'-0"	8'-8"	8'-9"	7'-4"	11'-5"	9'-9"	12'-2"	10'-6"
40 PSF	4'-7"	4'-2"	6'-0"	5'-9"	7′-9″	7′-8″	8′-5″	8'-4"	8'-2"	7'-0"	10'-8"	9'-4"	11'-5"	10'-0"
16" O.C.														
15 PSF	6'-6"	5'-4"	8'-6"	7'-4"	11'-0"	9'-8"	11"-11"	10'-6"	11'-0"	8'-9"	14'-9"	11'-9"	16'-0"	12'-8"
20 PSF	5′-8″	4'-9"	7'-4"	6'-8"	9'-7"	8'-9"	10'-4"	9'-6"	10'-0"	8'-0"	13'-0"	10'-8"	14'-0"	11'-6"
25 PSF	5'-0"	4'-6"	6'-7"	6'-2"	8'-7"	8'-2"	9'-2"	8'-10"	9'-0"	7′-6″	11'-8"	9'-10"	12'-6"	10'-8"
30 PSF	4'-7"	4'-2"	6'-0"	5′-9″	7′-9″	7′-8″	8'-5"	8'-4"	8'-2"	7′-0″	10'-8"	9'-4"	11'-5"	10'-0"
35 PSF	4'-4"	4'-0"	5′-6″	5′-6″	7'-4"	7'-4"	7′-9″	7′-9″	7′-7″	6'-7"	9'-10"	8'-10"	10'-7"	9′-7″
40 PSF	4'-0"	3'-9"	5'-2"	5'-2"	6′-9″	6'-9"	7'-4"	7'-4"	7′-0″	6′-5″	9'-2"	8'-6"	9'-10"	9'-2"
24" O.C.														
15 PSF	5'-4"	4'-7"	6'-10"	6'-5"	9'-0"	8'-6"	9'-8"	9'-2"	9'-6"	7′-8″	12'-4"	10'-4"	13'-2"	11'-0"
20 PSF	4'-7"	4'-2"	6'-0"	5′-9″	7′-9″	7′-8″	8′-5″	8'-4"	8'-2"	7′-0″	10′-8″	9'-4"	11'-5"	10′-0″
25 PSF	4'-0"	3'-10"	5′-5″	5′-5″	7′-0″	7′-0″	7′-6″	7′-6″	7′-4″	6′-6″	9'-6"	8'-8"	10'-3"	9′-5″
30 PSF	3'-9"	3'-8"	4'-10"	4'-10"	6′-5″	6'-5"	6'-10"	6'-10"	6′-8″	6'-0"	8′-8″	8'-2"	9'-4"	8'-9"
35 PSF	3'-6"	3'-6"	4'-6"	4'-6"	5′-10″	5′-10″	6′-5″	6-5"	6'-2"	5′-9″	8'-0"	7′-8″	8′-7″	8'-5"
40 PSF	3'-4"	3'-4"	4'-2"	4'-2"	5′-6″	5′-6″	5′-10″	5′-10″	5′-9″	5'-7"	7′-6″	7′-5″	8'-0"	8'-0"

## **DESIGN CRITERIA**

- Section properties for stress and deflection have been computed on the basis of the A.I.S.I. Specification for the Design of Cold-Formed Steel Structural Members, 1968 Edition.
- 2. Fy = 33 ksi. Fs = 20 ksi.
- The values of I were determined for deflection calculations.
- 4. Values shown are based on collateral wall materials furnishing adequate lateral support to the studs in the plane of the wall.

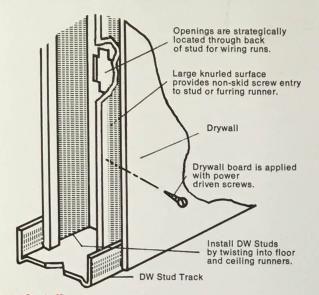
- 5. No Axial Loads permitted.
- Building code requirements should be followed as to maximum design heights and maximum deflections.
- 7. The limiting heights are based on the sectional and structural properties of the studs alone, with no consideration of the composite action of the studs and collateral materials.
- Values shown are based on the criteria that the studs and track are securely fastened to each other.

Specifications						
	SIZE		STANDARD LENGTHS	PACKA	GING	WEIGHT
	(A)	NO.	STANDARD LENGTHS	PCS. PER BDLE.	BDLS. PER SKID	WEIGHT
13/8 DW STUD 15/16	1%" 2½" ‡3¼" 3%" 4"	\$158 \$250 \$325 \$358 \$400	8', 9' 8', 9', 10' 8', 9', 10', 11', 12', 14', 16' 8', 9', 10', 11', 12', 14', 16'	20 10 10 10 10	35 50 40 40 40	344 391 455 470 492
DW TRACK	1%" 2½"  ‡3¼" 3%"  4"	T 158A T 158B T 250A T 250B T 325B T 358A T 358B T 400A T 400B (A-1" Leg- B-1316" Leg)	12' 12' 12' 12' 12' 12' 12' 12' 12' 12'	20 20 10 10 10 10 10 10	49 42 70 60 36 42 36 49 42	230 253 286 308 354 355 379 379 452
13% CW STUD – 20 GA. 15/6	2½" 3%" 4"	CS250 CS358 CS400	8' 9', 10' 8', 9', 10', 11', 12', 14', 16' 8', 9', 10', 11', 12', 14', 16' also to customer specification	1( 1( 1(	0	782 937 994
13/6 CW TRACK - 20 GA.	2½" 35%" 4"	CT250B CT358B CT400B	12' 12' 12'	10 10	)	682 835 886
DW FURRING RUNNER	<b>%</b> "	F78	12'	10	100	305
GALV. V BEAD	1" x 1" 1" x 1¼' 1¼" x 1¼' 1½" x 1½'	V501* V502** V503† V504††	7′, 8′, 10′ 7′, 8′, 10′ 7′, 8′, 10′ 7′, 8′, 10′	(Ft. pet 504, 50 504, 50 504, 50 504, 50	04, 500 04, 500	98 119 133 119
GALV. J. BEAD	% " GRDS. ½ " GRDS. % " GRDS.	J601 J602 J603	7′, 8′, 10′ 7′, 8′, 10′ 7′, 8′, 10′	602, 60 602, 60 602, 60	00, 600	132 139 146

<sup>\*</sup> V501 for use with  $\frac{1}{2}$ " or  $\frac{1}{2}$ " single layer wallboard construction. \*\*V502 for use with  $\frac{1}{2}$ " or  $\frac{1}{2}$ " single layer wallboard construction.

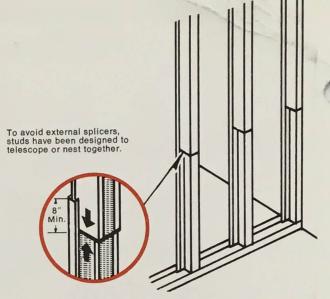
<sup>††</sup>V504 for use with clinching tool application.

<sup>‡</sup> Available on special order.

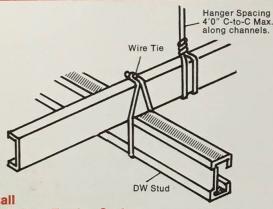


### How to Install A Wheeling Drywall Stud System

1. Align the ceiling and floor track, securing them in position with suitable fasteners, spaced not more than 24" O.C. 2. Position the studs vertically in the ceiling and floor track. They should not be spaced further than 16" or 24" O.C.—depending on the thickness of drywall board to be used. 3. All studs located adjacent to door and window frames, partition intersections and corners, should be secured to runner flanges by tight screw engagement through each stud flange and runner.



4. Locate studs not more than 2" from door jambs, abutting partitions, partition corners and other construction. Secure the studs to the jamb and head anchor clips of each door-or borrow light frame-by bolt or screw attachment. 5. Place a cut-to-length section of runner track, with web flange bend at each end, horizontally over metal door and borrow light frames. Then secure by screw attachment to adjacent vertical studs. 6. Position a cut-to-length stud at the location of vertical joints, over the door frame header, extending to the ceiling runner.

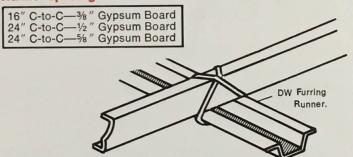


### How to Install A Wheeling Ceiling Furring System

1. Anchor suspended ceilings securely by using hangers attached to the structural frame, or imbedded in concrete slabs. Hanger spacing should not exceed 4' along the carrying channels. 2. Where spacing of main supports exceeds 4', Wheeling studs should be used according to the recommendations of the following chart:

Type of Furring	Center to Spa Wallboard	cing	Main Support Max. Spacing Center to Center
	1/2 "	5/8 "	
F-78 Furring Runner	24"	24"	4'
S-158 Steel Stud	24"	24"	5'
S-250 Steel Stud	24"	24"	6'
S-358 Steel Stud	24"	24"	8′

### Max. DW Furring **Runner spacing**



Position ceiling furring runners and drywall studs at right angles to the carrying channels or main support members, and securely fastened. End splices should be made by telescoping, or nesting, no less than 8" and securing by wire tying. 4. The application of gypsum board should be made with the long dimension of the board at right angles to the furring runners wherever practical, and where a fire rating is required. End joints should be centered over furring runners (where back blocking is used, float end joints between furring runners), neatly fitted and staggered. Support all cut-outs made in the gypsum board in the ceiling. Use a maximum 12" O.C. spacing for screw fasteners in the field of the board, and 12" O.C. along abutting ends or edges.

Screw heads should be slightly depressed below the board's surface, and screws should not be placed closer than %" from the ends and edges of the board.

SALES OFFICES AND WAREHOUSES

Atlanta, Ga. Boston, Mass. Buffalo, N. Y. Chicago, III. Columbus, Ohio

Detroit, Mich. Houston, Texas Kansas City, Mo. Louisville, Ky. Los Angeles, Calif.

Minneapolis, Minn. Oakland, Calif. New Orleans, La. New York, N. Y. (Jamesburg, N. J.) Orlando, Fla.

Philadelphia, Pa. (Jamesburg, N. J.) Richmond, Va. San Francisco, Calif.

Statesville, N. C. St. Louis, Mo. Wheeling, W. Va.



# Wheeling Corrugating Company

# Wheeling Steel Framing

The new cost-cutting system



# A sophisticated building concept that lowers costs... speeds construction

Wheeling Steel Framing is a lightweight structural framing system ideally suited for wall, roof and floor construction. Designed primarily for buildings where flexibility of design and ease of installation are deciding factors in ultimate costs, Wheeling Steel Framing offers architects and engineers a system with proven capabilities for one to three-story commercial, institutional and residential building require-

ments. This sophisticated and practical system fills a long-standing need for an effective and economical means of constructing intermediate size and light occupancy buildings. Components of the system include a complete line of studs, track and bridging . . . plus two types of joists. All have been designed to provide complete design flexibility with a fast, low-cost structural frame to which any surface material can be attached. Its applications also include interior load-bearing partitions, exterior curtain walls, fire walls, high bay walls, parapet walls, roof trusses, floor and roof joists, suspended ceilings, cantilevers, and doorbuck reinforcing.

Page

#### contents

Characteristics of the System Physical and Structural Properties Web Stiffening Criteria Maximum Allowable Reactions and Concentrated Loads Allowable Uniform Loads for Joists Allowable Uniform Loads for Punched Studs Used as Joists Allowable Axial Load for Studs Interior "No Wind" Maximum Allowable Loads for 15#, 20#, 25#, 30#, 40# Wind Loading Typical Assembly of Structural Steel Framing Specification, Material, Fabrication, Erection Fabricating and Welding Recommendations Studs Used as Curtain Wall Maximum Allowable Loads for Span Heights in Feet Fire Rating Information, Design Notes Recommended Attachment of Collateral Materials	6 to 11 12, 13 14 15, 16, 17 18, 19, 20 21 22 to 26 27 28 29, 30 31
Marden M.	

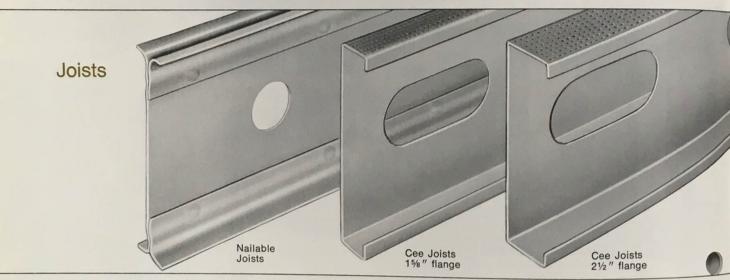


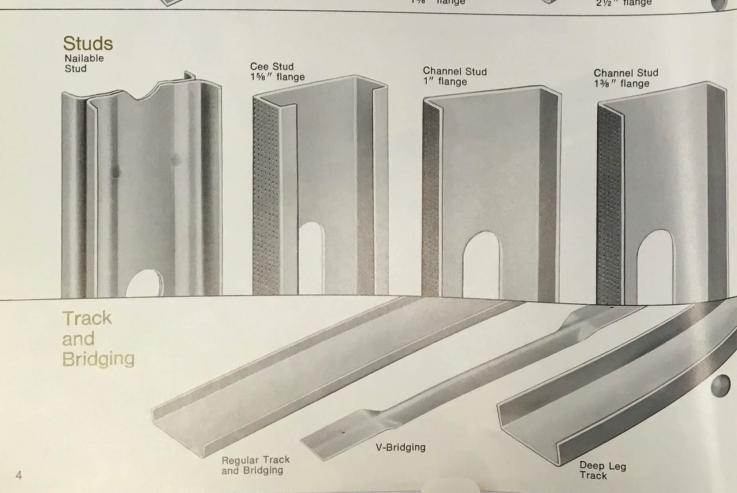
## The components of the System

All components of the Wheeling Steel Framing System are designed to obtain optimum performance from the area of steel. The physical properties of the various sections were developed to achieve maximum rigidity and minimum deflection when loads are imposed upon them. Most important, when compared on a size and weight basis, Wheeling Steel Framing Systems

are lighter and stronger than other systems now available to builders! And builders have a wider variety of gages, sizes and shapes to choose from.

Steel studs and joists will not warp, shrink or swell, and they form firm and level surfaces which are immediately ready to receive collateral materials. The rigidity of the Wheeling Steel Framing System





provides protection against nail "pops" or plaster cracks due to building movement. The Steel Framing System provides an incombustible building that is not affected by vermin, rot or climatic changes. And because the components are made of steel, fire insurance rates generally are lower. The high tensile steel is available in two finishes: zinc chromate primer and a weldable galvanized finish.

#### Note:

The technical data contained in this catalog is based on AISI Specification for the Design of Cold Formed Structural Members, 1968 Edition. Physical and structural properties were determined by computer. All data was derived and formulated by Dr. Wei-Wen Yu, Associate Professor of Civil Engineering, University of Missouri, Rolla, Missouri.

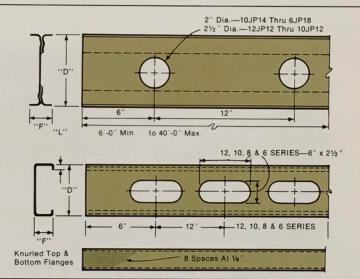
No information presented herein should be used to replace the judgment of experienced structural engineers.

#### **Joists**

Joists are produced in depths of 6, 8, 9, 10 and 12 inches. The nailable joist and both types of cee joists can be furnished with a punched or unpunched web. All are available in either galvanized or prime painted steel, Joists are manufactured to a minimum of 6'0" and a maximum of 40'0" lengths.

#### Note:

Exact dimensional data for Depth (D), Flange (F), and Lip (L), refer to physical and structural properties on pages 12 and 13.

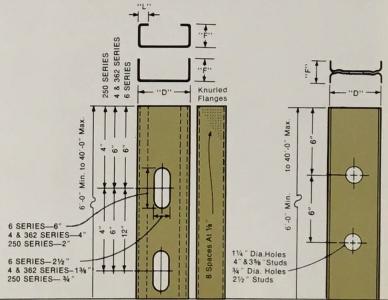


#### Nailable Studs

Produced in depths of 2½, 3% and 4 inch sizes. Furnished with a punched or unpunched web and available in galvanized or prime painted steel. Manufactured to a minimum of 6'0" and a maximum of 40'0" lengths.

#### Channel and Cee Studs

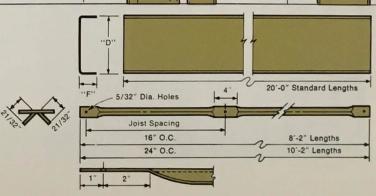
Cee studs are produced in depths of 2½, 3%, 4 and 6 inch sizes, with a 1% inch knurled flange and a ½ inch return lip. Channel studs are produced to the same depth dimensions but have a 1 inch or 1% inch knurled flange and no return lip. All can be furnished with a punched or unpunched web. Available in galvanized or prime painted steel. Manufactured to a minimum of 6′0″ and a maximum of 40′0″ lengths.



#### Track and Bridging

Track—regular and deep leg—is produced to accommodate all studs and joists. Designed for floor and ceiling stud attachment, sill and fascia. Available in galvanized or prime painted steel.

Two types of bridging are available for joists and studs. Channel, produced in 18 gage galvanized or prime painted steel, and V bridging, produced in 16 gage galvanized.



Compatibility with all types of building materials and techniques of construction

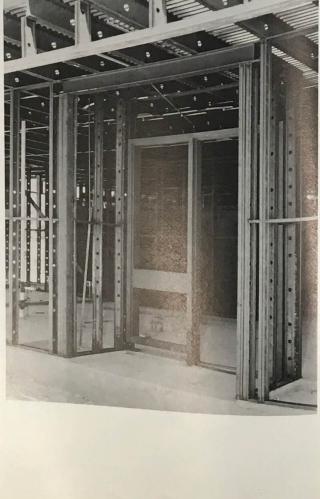
The Wheeling Steel Framing System is designed to accommodate all types of exterior finishing . . . from traditional stone and brick to intricate metal, wood and concrete panels and composite facing materials. And because of its inherent light weight, the Wheeling System will still impose less weight on the

foundation, while providing the required structural support.

Because interior wall finishing materials can be nailed or screwed to studs, and electrical and plumbing lines can be run through these studs, no restrictions are placed on the use of the System throughout the entire structure.



The Wheeling System provides components for both load-bearing and non-load-bearing walls and partitions. Together they offer the designer a wall system that allows him to create any form and finish he requires.



## ... plus unlimited design versatility

The components which comprise the Wheeling Steel Framing System can be combined for use in virtually any type of one to three-story structure. In the relatively short time since its creation, the Wheeling System has been used extensively in low-rise apartments, nursing homes, townhouses, warehouses, motels, schools, community buildings, and many residences.

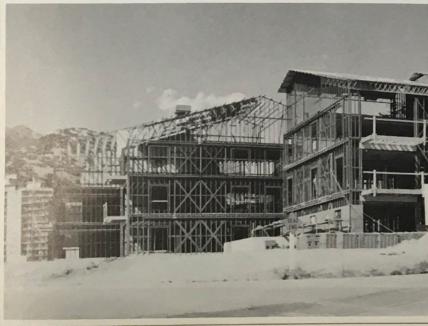
The joists, studs and bridging, basic components in the System can also be used to complement the overall structural system of large buildings employing steel or concrete structural members.

The Wheeling System has also found usage as framing for penthouses, carports, garages, framed walkways and canopies.



No limitations are placed on the designer's freedom to create the precise form he wants when he uses the Wheeling Steel Framing System.





### Off-site fabrication, faster erection: The savings are significant

made from Wheeling System com- chromate primer and a weldable ponents can be pre-fabricated either galvanized finish-the Wheeling off-site or in a special shop set up at System components are manufacthe construction site. Then ready for tured under strict quality control quickly and easily-and the savings uniformity from section to section. in time and construction costs are significant.

erection, these sections go in place standards, thus assuring consistent

All necessary work such as cutting, welding and assembly of wall, floor, and roof components can be performed off-site and complete sections prefabricated for shipment to the job site.





These recognized economies and the speed with which structures can be made ready for occupancy have resulted in a dramatic acceptance of Wheeling Steel Framing for all types of low-rise buildings, both large and small.

Other advantages of the Wheeling System include its ability to remain unaffected by termites, rot and climatic changes; a rigidity which provides protection against nail "pops" or plaster cracks due to building movement, an incombustibility that can provide for a lower insurance rate.





Entire panels are easily lifted into place and erection of a complete framing system is accomplished quickly. The light weight of Wheeling Steel Framing components often allows workers to lift complete sections into place by hand.

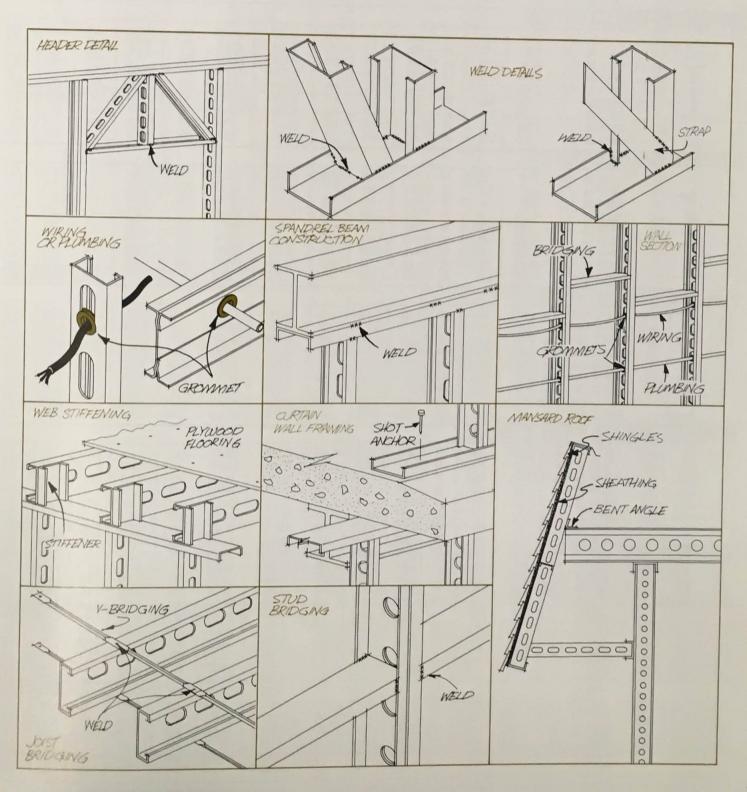


## True compatibility in construction

The same practices and techniques used in the construction of other building systems can be employed with the Wheeling Steel Framing System. Both interior and exterior finishing materials for walls, floor, ceilings, and roof can be attached by any one of the conventional methods being used in the building industry today.

Drawings on these pages and elsewhere in this catalog illustrate some of the construction details of how the Wheeling Steel Framing System is used with all types of insulation and facing material.





LEGEND (Example)		Pł	HYSI	CAL	& 5	STRU	JCTL	JRAL	PROF	PERTI	ES -	STE	EL F	RAM	ING
Joist Gage							* * Net		Allowable	Re			Axis 1-		Axis 2-2
(12) (1) (P) (12)	Section	Lip In.	in.	in.	Nomi- nal	Thick- ness	Weight Lbs.	Net Area Sq. In.	Compression Stress	Moment M <sub>x-x</sub> InLbs.	Column Factor Q	l in.4	C 1- 0	r in. Gross	
PUNCHED NAIL	Designation	STS	D	F	Gage	in.	Per Ft.	oq. III.	тс р.з.т.	IIILUS.	1 6	1 111.5	S in.3	Area	l in,4
TORONED MAIL	12 JP 12		12	2.813	12	.1046	6.957	1.778	30,000	199,294	.695	39.859	6.643	4.429	.400
<b>Y</b>	12 JP 14 * 10 JP 12		12 10	2.250 2.813	14 12	.0747	4.706 6.228	1.194 1.568	30,000 30,000	129,600 152,919	.613 .767	25.920 25.487	4.320 5.097	4.341 3.742	.147
	10 JP 14 10 JP 15		10 10	2.375 2.250	14 15	.0747	4.289 3.969	1.101	29,619 29,700	100,481 92,397	.681	16.962 15.555	3.392 3.111	3.689	.399
	9 JP 14 9 JP 16		9	2.375 1.938	14 16	.0747	4.028 3.058	1.026 .774	29,619 30,000	86,118 63,682	.722 .676	13.084 9.552	2.908	3.343	.137 .172
	8 JP 14 8 JP 16		8	2.375	14 16	.0747	3.768 2.850	.951 .714	29,619 30,000	72,517	.767	9.793	2.448	3.277 2.990	.075 .171
ال	6 JP 16 6 JP 18		6	1.938	16	.0600	2.433	.594	30,000	53,368 34,629	.722 .832	7.116 3.463	1.779	2.930 2.215	.075 .075
UNPUNCHED N	AILABLE S	TUI		1.875	18	.0480	1.929	.471	20,000	18,284	.826	2.743	.914	2.214	.054
	4 S 15		4	2.25	15	.070	2.779	.797	29,700	24,509	.975	1.650	.825	1.439	.136
~	4 S 16 4 S 18		4	1.94 1.81	16 18	.060	2.254 1.770	.647 .508	30,000 20,000	19,211 9,914	.941 .931	1.281 .991	.640	1.407 1.397	.075
	362 S 15 362 S 16		35/8 35/8	2.25 1.94	15 16	.070	2.596 2.100	.745 .602	29,700 30,000	21,207 16,555	.990 .985	1.294	.714	1.318	.136
ا	362 S 18 250 S 16		35/8 21/2	1.81 1.94	18 16	.048	1.645 1.629	.472 .467	20,000	8,533 9,598	.977 1.000	.773	.427	1.280	.075
	250 S 18 250 S 20		2½ 2½	1.81 1.75	18 20	.048	1.270 .945	.364 .271	20,000 19,277	4,928 3,534	1.000	.400 .308 .229	.320	.925	.074
PUNCHED NAIL		DS							10,277	3,334	.304	.229	.183	.919	.033
$\sim$	4 SP 15 4 SP 16		4	2.25 1.94	15 16	.070	2.679 2.169	.622 .497	29,699 30,000	24,170 18,919	.773	1.628	.814	1.439	.135
	4 SP 18 362 SP 15		4 35/8	1.81 2.25	18 15	.048	1.702 2.496	.388	20,000	9,758	.769 .765	1.261 .976	.631	1.407	.074
	362 SP 16 362 SP 18		35/8 35/8	1.94 1.81	16 18	.060	2.013 1.673	.452	30,000	20,834 16,233	.757 .752	1.271 .981	.702 .541	1.318 1.289	.135
	250 SP 16 250 SP 18		2½ 2½	1.94 1.81	16 18	.060	1.598 1.246	.378	17,043 30,000	8,026 9,497	.648 .808	.854 .396	.471 .317	1.319	.048
PUNCHED #250	250 SP 20	TS	21/2	1.75	20	.036	.927	.217	20,000 19,277	4,874 3,495	.803 .773	.305 .227	.244	.919	.048
	12 CP 12 EWF	3/4	12	21/2	12	.105	5.858	1.598	30,000	170 550					
	12 CP 14 EWF * 10 CP 12 EWF	3/4 3/4	12 10	2½ 2½	14 12	.0747 .105	4.221 5.129	1.152	30,000 30,000 30,000	178,558 129,739	.5977 .5327	35.712 25.948	5.952 4.325	4.391 4.411	1.184
	10 CP 14 EWF 8 CP 14 EWF	3/4	10 8	2½ 2½	14 14	.0747	3.701 3.180	1.003	30,000	137,312 99,958	.6676	22.885 16.660	4.577 3.332	3.735 3.754	1.106
	8 CP 15 EWF 8 CP 16 EWF	5/8 5/8	8	2½ 2½	15 16	.0673	2.815 2.509	.7543 .6724	30,000	73,127 64,779	.6773 .6502	9.750 8.641	2.438 2.159	3.077 3.077	.745 .632
	6 CP 15 EWF 6 CP 16 EWF	5/8 5/8	6	2½ 2½	15 16	.0673 .060	2.346 2.092	.6197	30,000	56,102 43,657	.6079 .7529	7.581 4.368	1.870 1.455	3.081 2.379	.538
PUNCHED #158								.5520	30,000	37,666	.7049	3.828	1.256	2.383	.484
	12 CP 12 12 CP 14 *	1/2	12 12	15/8 15/8	12 14	.105 .075	5.038 3.636	1.363	30,000	138,624	.539	27.725	4.621	4.142	.330
	12 CP 15 * 12 CP 16 *	1/2	12 12	15/8 15/8	15 16	.067	3.284 2.926	.889	30,000	101,105 91,562	.466 .447	20.221 18.312	3.370 3.052	4.166 4.172	.252 .231
	10 CP 12 10 CP 14	1/2 1/2	10 10	15/8 15/8	12 14	.105	4.309 3.115	1.153	30,000	81,784 104,417	.428	16.357 17.403	2.726 3.481	4.178 3.521	.209 .312
	10 CP 15 10 CP 16 *	1/2	10 10	15/8 15/8	15 16	.067	2.815 2.509	.754	30,000	76,351 69,187	.530	12.725 11.531	2.545 2.306	3.543 3.549	.239
	8 CP 14 8 CP 15	1/2	8	15/8 15/8	14 15	.075	2.594 2.346	.685	30,000	61,838 54,539	.488	10.306 7.272	2.061	3.554 2.907	.197 .219
	8 CP 16 8 CP 18	1/2 1/2	8	15/8 15/8	16 18	.060	2.092	.553	30,000	49,463 44,246	.591 .567	6.595 5.900	1.649 1.475	2.912 2.917	.201 .182
	6 CP 15 6 CP 16	1/2	6	15/8 15/8	15 16	.067	1.877	.445	20,000	23,831 32,350	.563	4.766 3.235	1.192	2.925	.149
	6 CP 18 6 CP 20	1/2 1/2	6	15/8 15/8	18 20	.048	1.349	.433	30,000 20,000	28,974 15,637	.675	2.897	1.078	2.260	.157
	4 CP 14 4 CP 15	1/2	4 4	1% 1%	14 15	.075	1.776	.264	20,000 30,000	11,892 20,687	.614	2.346	.782	2.267	.099
	4 CP 16 4 CP 18	1/2 1/2	4 4	15/8 15/8	16 18	.060	1.437	.426	30,000	18,819 16,887	.821	1.379	.690	1.560	.156
	4 CP 20 362 CP 14	1/2 1/2	4 35/8	15/8 15/8	20	.036	.877	.307	20,000	9,140 6,970	.822	1.126	.563	1.568	.116
	362 CP 15 362 CP 16	1/2	35/8 35/8	15/8 15/8	15	.067	1.6787	.443	30,000 30,000	18,062	.759	.697 1.092	Charles (Charles)	1.580	.161
	362 CP 18 362 CP 20	72 1/2 1/2	35/8 35/8	15/8 15/8	18 20	.060 .048 .036	1.359	.359	30,000	16,440 14,760	.8125	.9933	.492	1.429 1.433	.147
*h/t>150 No	te. Refer to Desi	-					.830 Page 27	.219	20,000	7,996 6,104	.815 .794	.725 .553		1.439 1.445	.109

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### PHYSICAL & STRUCTURAL PROPERTIES - STEEL FRAMING

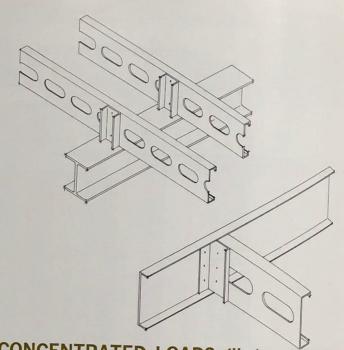
LEGE	ND (Example)		P	н12	ICAL	. & :	SIR	UCTU	JRAL	- PROF	PERTI	IES -	STE	EL F	RAM	ING
0	ection Gar							* * Net		Allowable	Re			Axis 1	-1	Axis 2-2
Depth 21/	Ministra and the second	Section Designation		in. D	Flange in. F	nal Gage	Thick- ness in.	Weight Lbs. Per Ft.	Net Area Sq. In.	Compression Stress	Moment M <sub>x-x</sub> InLbs.	Column Factor Q	l in.4	S in.3	r in. Gross Area	1 in.4
PUN	CUED #13					(cont										
		250 CP 16 250 CP 18 250 CP 20	½ ½ ½	2½ 2½ 2½ 2½	15% 15% 15%	16 18 20	.060 .048 .036	1.230 .992 .753	.329 .265 .201	30,000 20,000 20,000	9,124 4,961 3,800	.880 .881 .882	.380 .310 .238	.304 .248 .190	1.012 1.107 1.023	.121 .099 .077
PUN	CHED #13	8 CHANNE	LS	TUDS	5											
		6 WP 15 6 WP 16 6 WP 18 6 WP 20 4 WP 16 4 WP 18 4 WP 20 362 WP 16 362 WP 18 362 WP 20		6 6 6 4 4 4 35/8 35/8 35/8	1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1% 1%	15 16 18 20 16 18 20 16 18 20	.067 .060 .048 .036 .060 .048 .036 .060 .048	1.588 1.415 1.136 .857 1.177 .946 .714 1.100 .883 .667	.402 .359 .288 .217 .306 .246 .186 .284 .228 .173	21,947 19,773 12,758 10,330 19,773 12,758 10,331 19,773 12,758 10,331	18,951 15,256 7,939 4,871 8,748 4,564 2,808 7,618 3,978 2,450	.516 .451 .435 .326 .520 .504 .408 .511 .495	2.590 2.315 1.867 1.415 .885 .716 .544 .698 .565 .430	.864 .772 .622 .472 .442 .358 .272 .385 .312 .237	2.166 2.170 2.176 2.181 1.520 1.525 1.530 1.393 1.400 1.404	.072 .064 .052 .040 .059 .048 .036 .056 .045
		250 WP 16 250 WP 18		2½ 2½	13/8 13/8	16 18	.060	.970 .780	.254	19,773 12,758	4,708 2,467	.560 .543	.298	.238	1.001	.051
DUM	CUED #10	250 WP 20	1 6	21/2	13/8	20	.036	.589	.155	10,331	1,525	.440	.185	.148	1.012	.032
PUN	CHED #10	6 NP 16	LS	TUDS 6	1	16	.060	1.259	.314	25,626	16,393	.525	1.919	.640	2.076	.026
		6 NP 16 6 NP 20 4 NP 16 4 NP 18 4 NP 20 362 NP 16 362 NP 18 362 NP 20 250 NP 16 250 NP 18		6 6 4 4 4 3 1 2 3 2 2 2 1/2 2 1/2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	18 20 16 18 20 16 18 20 16 18	.048 .036 .060 .048 .036 .060 .048 .036 .060	1.011 .763 1.021 .821 .620 .943 .758 .573 .813 .655	.252 .191 .262 .210 .159 .239 .193 .146 .209	16,650 13,614 25,626 16,650 13,614 25,626 16,650 13,614 25,626 16,650	8,599 5,333 9,107 4,792 2,981 7,857 4,139 2,577 4,732 2,502	.508 .380 .650 .634 .496 .636 .621 .508 .703	1.549 1.175 .711 .576 .438 .556 .451 .343 .231	.517 .392 .355 .288 .219 .307 .249 .189 .185	2.082 2.088 1.451 1.457 1.462 1.331 1.336 1.342 .958 .963	.021 .016 .024 .020 .015 .023 .019 .014 .021
		250 NP 20	_	21/2	1	20	.036	.496	.128	13,614	1,564	.562	.144	.115	.968	.013
UNF	UNCHED	16 GAGE 1	RA	1	1	10	000	2 000	902	29,528	56,992	0.31	11.76	1.93	3.83	0.01
		12 T 16 10 T 16 9 T 16 8 T 16 6 T 16 4 T 16 362 T 16 250 T 16		12 <sup>3</sup> / <sub>16</sub> 10 <sup>3</sup> / <sub>16</sub> 9 <sup>3</sup> / <sub>16</sub> 8 <sup>3</sup> / <sub>16</sub> 6 <sup>3</sup> / <sub>16</sub> 4 <sup>3</sup> / <sub>16</sub> 3 <sup>13</sup> / <sub>16</sub> 2 <sup>11</sup> / <sub>16</sub>	3/4 3/4 3/4 3/4 3/4 3/4 3/4	16 16 16 16 16 16 16 16	.060 .060 .060 .060 .060 .060	2.800 2.383 2.175 1.966 1.550 1.133 1.055 .820	.803 .684 .624 .564 .445 .325 .303 .235	29,528 29,528 29,528 29,528 29,528 29,528 29,528 29,528	41,620 34,816 28,602 17,938 9,629 8,334 4,943	0.36 0.40 0.44 0.54 0.72	7.18 5.42 3.97 1.88 0.68 0.54 0.23	1.41 1.18 .97 .61 .33 .28 .17	3.24 2.95 2.65 2.06 1.45 1.33 .98	0.01 0.01 0.01 0.01 0.01 0.01 0.01
UNP	UNCHED	16 GAGE I	EE		TRA	CK										
l		12 T 16 DL 10 T 16 DL 9 T 16 DL 8 T 16 DL 6 T 16 DL 4 T 16 DL 362 T 16 DL 250 T 16 DL		12 <sup>3</sup> / <sub>16</sub> 10 <sup>3</sup> / <sub>16</sub> 9 <sup>3</sup> / <sub>16</sub> 8 <sup>3</sup> / <sub>16</sub> 6 <sup>3</sup> / <sub>16</sub> 4 <sup>3</sup> / <sub>16</sub> 3 <sup>13</sup> / <sub>16</sub> 2 <sup>11</sup> / <sub>16</sub>	1½ 1½ 1½ 1½ 1½ 1¾ 1¾ 1¾ 1¾	16 16 16 16 16 16 16 16	.060 .060 .060 .060 .060 .060	3.113 2.696 2.487 2.280 1.966 1.550 1.471 1.237	.893 .774 .714 .654 .564 .445 .422 .355	16,539 16,539 16,539 16,539 12,471 12,471 12,471 12,471	40,874 30,780 26,228 22,005 12,102 7,102 6,275 4,004	.243 .278 .300 .325 .318 .383 .397 .416	15.060 9.480 7.285 5.447 3.002 1.192 .959 .431	2.471 1.861 1.586 1.331 .970 .569 .503 .321	4.106 3.500 3.195 2.886 2.307 1.638 1.507 1.103	.108 .105 .103 .101 .147 .132 .129 .115
UNF	UNCHED	18 GAGE	ΓRA	CK			_		1	10.000	0.452	E20	1 510	401	2.062	.011
-		6 T 18 4 T 18 362 T 18 250 T 18		6 <sup>3</sup> / <sub>16</sub> 4 <sup>3</sup> / <sub>16</sub> 3 <sup>13</sup> / <sub>16</sub> 2 <sup>11</sup> / <sub>16</sub>	3/4 3/4 3/4 3/4 3/4	18 18 18 18	.048 .048 .048 .048	1.243 .910 .848 .660	.357 .261 .243 .190	19,268 19,268 19,268 19,268	9,452 5,092 4,411 2,627	.528 .696 .738 .892	1.518 .553 .436 .183	.491 .264 .229 .136	2.063 1.456 1.339 .983	.010 .010 .010
UNF	UNCHED	18 GAGE	DEE	P LE	G TRA	CK				,		1			0.010	
l		6 T 18 DL 4 T 18 DL 362 T 18 DL 250 T 18 DL		6 <sup>3</sup> / <sub>16</sub> 4 <sup>3</sup> / <sub>16</sub> 3 <sup>13</sup> / <sub>16</sub> 2 <sup>11</sup> / <sub>16</sub>	1¾ 1¾ 1¾ 1¾ 1¾	18 18 18 18	.048 .048 .048 .048	1.577 1.243 1.181 .994	.452 .357 .339 .285	10,561 10,561 10,561 10,561	8,257 4,857 4,294 2,749	.381 .464 .482 .528	2.419 .963 .775 .350	.782 .460 .407 .260	2.312 1.643 1.512 1.108	.119 .107 .104 .093
UNP	UNCHED	18 GAGE I	BRII	DGIN	G				1 000	10.000	8,575	.538	1.39	.477	1.98	.016
		6 B 18 4 B 18 362 B 18 250 B 18		5 <sup>13</sup> / <sub>16</sub> 3 <sup>13</sup> / <sub>16</sub> 3 <sup>7</sup> / <sub>16</sub> 2 <sup>5</sup> / <sub>16</sub>	3/4 3/4 3/4 3/4	18 18 18 18	.048 .048 .048 .048	1,22 .848 .785 .640	.351 .243 .225 .184	18,268 19,268 19,268 17,960	8,575 4,411 3,773 2,213	.738 .785 .894	.436 .337 .143	.229 .196 .123	1.339 1.222 .881	.010 .010 .010
-		Note: Refer to De	esign						THE							

#### WEB STIFFENING-RECOMMENDED PRACTICES

Concentrated loads or reactions of beams, applied over short lengths, produce a high local intensity of load which can cripple unstiffened thin webs. Web stiffeners should be used if the reactions and/or concentrated loads exceed the values as shown in the tables below.

Notes:

- 1) Bearing requirements End bearing—11/2" min. Interior support bearing—3" min.
- 2) All sections required to transfer vertical loads from load-bearing walls should use end stiffeners and/or interior stiffeners. Also, when a web hole is located above a support a stiffener should be placed at the hole.



MAXIMUM ALLOWABLE REACTIONS AND CONCENTRATED LOADS (lbs)

	CONCENTE	RATED LOAD ER OR SIMPI	ON OUTER	END OF		CONCENTE	RATED LOAD	BETWEEN :	SUPPORTS, OUS BEAM	OR
Length of Bearing inches	18 ga. (0.0478 in.)	16 ga. (0.0598 in.)	15 ga. (0.0673 in.)	14 ga. (0.0747 in.)	12 ga. (0.1046 in.)	18 ga. (0.0478 in.)	16 ga. (0.0598 in.)	15 ga. (0.0673 in.)	14 ga.	12 ga. (0.1046 in
2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5	920 968 1,012 1,053 1,090 1,126 1,159 1,191	1,371 1,439 1,501 1,557 1,610 1,659 1,706 1,751	1,694 1,776 1,849 1,917 1,980 2,039 2,095 2,148	2,044 2,139 2,225 2,304 2,378 2,447 2,512 2,575	3,764 3,921 4,064 4,195 4,317 4,431 4,539 4,642	1,829 1,956 2,070 2,174 2,272 2,364 2,450 2,533	2,686 2,863 3,022 3,169 3,305 3,434 3,555 3,670	3,293 3,504 3,695 3,870 4,033 4,186 4,331 4,469	3,946 4,192 4,415 4,620 4,810 4,989 5,159 5,320	7,102 7,511 7,880 8,219 8,535 8,832 9,113 9,380

This table was computed on the basis of Fy = 50 ksi. For Fy = 33 ksi, use the values given in the Table times 0.67. The table was based on Section 3.5 (b) of the AISI specification. It can only be used for I sections.

CEE JO	OIST	
Bearing	CONCENTRATED LOAD ON OUTER END OF CANTILEVER OR SIMPLE END REACTION	CONCENTRATED LOAD BETWEEN SUPPORTS, OR INTERIOR REACTION OF
5"		CONTINUOUS BEAM

Bearing	18 ga.	16 ga.	14			
		To ga.	14 ga.	18 ga.	16 ga.	14 ga
2.5 3.5 4.0 5.5	379 447 481 582	685 813 877 1,069	1,136 1,345 1,450 1,763	847 915 950 1,053	1,414 1,521 1,574 1,733	2,296 2,450 2,527 2,757

8"

Bearing	16 ga.	15 ga.	14			
2.5			14 ga.	16 ga.	15 ga.	14 ga.
3.5 4.0 5.5	568 650 691 813	780 900 961 1,141	1,010 1,169 1,249 1,488	1,283 1,366 1,408 1,534	1,691 1,798 1,851 2,012	2,142 2,272 2,338 2,533

This table was computed on the basis of Fy = 50 ksi.

CEE JO	IST	
Bearing	CONCENTRATED LOAD ON OUTER END OF CANTILEVER OR SIMPLE END REACTION	CONCENTRATED LOAD BETWEEN SUPPORTS, OR INTERIOR REACTION OF CONTINUOUS BEAM

Bearing	15 ga.	14 ga.	12 ga.	15 ga.	14 ga.	12 !
2.5	658	883	1,979	1,548	1,989	4,25
3.5	730	993	2,252	1,632	2,095	4,45
4.0	766	1,048	2,389	1,674	2,149	4,56
5.5	874	1,212	2,799	1,800	2,309	4,86

Bearing	14 ga.	12 ga.	14 ga.	12
2.5	757	1,842	1,833	4 4 4 4
3.5	817	2,061	1,917	
4.0	847	2,171	1,959	
5.5	937	2,500	2,085	

The table was based on Section 3.5 (a) of the AISI specification. It can only be used for beams having unreinforced webs.

TABLE 1 ALLOWABLE UNIFORM LOADS FOR JOISTS IN LRS. PER

IN	BLE I	ALLUVY	ADL	E UI	VIFC	KM	LO	ADS	FOR	JO	ISTS	IN	LBS	. PI	ER S	Q. F	T.	
SPAN		ONE END			TOTAL	SPAN	1					E SPAN				AN CO	ONDITI	
FT.	SECTION	REACTION	12"	16"	24"	36"	48"	60"	12"	16"	24"	36"	48"	60"	24"	48"	24"	48"
30	12 JP 12 12 JP 14* 10 JP 12 12 CP 12 EWF 12 CP 14 EWF	2214 1440 1699 1984 817	148 96 113 132 55	111 72 85 99 41	74 48 57 66 27	49 32 38 44 18	37 24 28 33 14	30 19 23 27 11	65 42 41 58 42	48 32 31 43 32	32 21 21 29 21	22 14 14 19 14	16 11 10 15 11	13 8 8 12 8	92.3 72 70.8 64 29	46.1 30 35.4 32 15	61 40 39 55 29	30.5 20 19.5 27 15
29	12 JP 12 12 JP 14* 10 JP 12 12 CP 12 EWF 12 CP 14 EWF	2291 1490 1758 2052 817	158 103 121 142 56	119 77 91 106 42	79 51 61 71 28	53 34 41 47 19	40 26 30 35 14	32 21 24 28 11	71 46 46 64 47	54 35 34 48 35	36 23 23 32 32 23	24 16 15 21 16	18 12 12 16 16	14 9 9 13 9	98.7 77 75.8 66 29	49.4 32 37.9 33 15	67.5 44 43.2 61 29	33.8 22 21.6 30 15
28	12 JP 12 12 JP 14* 10 JP 12 12 CP 12 EWF 12 CP 14 EWF	2373 1543 1821 2061 817	170 110 130 147 58	127 83 98 110 44	85 55 65 74 29	57 37 43 49 20	42 28 33 37 15	34 22 26 29 12	79 52 51 71 52	60 39 38 53 39	40 26 26 36 26	27 17 17 24 17	20 13 13 18 13	16 10 10 14 10	105.9 83 81.3 69 31	53 34 40.6 34 16	75 49 48 67 31	37.5 24 24 34 16
27	12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 12 CP 12 EWF 12 CP 14 EWF	2460 1600 1888 1241 1140 2061 817	182 119 140 92 85 153 61	137 89 105 69 63 115 45	91 59 70 46 42 76 30	61 40 47 31 28 51 20	46 30 35 23 21 38 15	37 24 28 18 17 31 12	89 58 57 38 35 79 58	66 43 43 28 26 60 43	44 29 28 19 17 40 29	30 19 19 13 12 26 19	22 14 14 9 9 20 14	18 12 11 8 7 16 12	113.9 86 87.4 57.4 52.8 71 32	57 36 43.7 28.7 26.4 36 16	83.7 54 53.5 35.6 32.7 71 32	41.8 27 26.8 17.8 16.3 36 16
26	12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 12 CP 12 EWF 12 CP 14 EWF	2555 1662 1961 1288 1185 2061 817	197 128 151 99 91 159 63	148 96 113 74 68 119 47	98 64 76 50 46 79 31	66 43 50 33 30 53 21	49 32 38 25 23 40 16	39 26 30 20 18 32 13	99 65 64 42 39 89 63	74 48 48 32 29 67 47	50 32 32 21 19 44 31	33 22 21 14 13 30 21	25 16 16 10 10 22 16	20 13 13 8 8 18 13	122.8 89 94.3 61.9 57 74 34	64.1 37 47.1 31 28.5 37 17	93.7 61 59.9 39.9 36.6 74 34	46.9 31 30 19.9 18.3 37 17
25	12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 12 CP 12 EWF 10 CP 12 EWF	2657 1728 2039 1340 1232 2061 817 1831	213 138 163 107 99 165 65 147	159 104 122 80 74 124 49 110	106 69 82 54 49 82 33 73	71 46 54 36 33 55 22 49	53 35 41 27 25 41 16 37	43 28 33 21 20 33 13 29	112 73 71 47 44 100 65 64	84 54 54 36 33 75 49 48	56 36 36 24 22 50 33 32	37 24 24 16 15 33 22 21	28 18 18 12 11 25 16 16	22 15 14 10 9 20 13 13	132.9 92 101.9 67 61.6 77 35 81	66.4 39 51 33.5 30.8 39 17 41	105.4 69 67.4 44.9 41.1 77 35 61	52.7 34 33.7 22.4 20.6 39 17 30
24	12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 9 JP 14 12 CP 12 EWF 12 CP 14 EWF 10 CP 12 EWF	2768 1800 2124 1396 1283 1196 2061 817 1907	231 150 177 116 107 100 172 68 159 83	173 113 133 87 80 75 129 51 119 62	115 75 89 58 54 50 86 34 80 41	77 50 59 39 36 33 57 23 53 28	58 38 44 29 27 25 43 17 40 21	46 30 35 23 21 20 34 14 32 17	126 82 81 54 49 41 113 68 72 53	95 62 60 40 37 31 85 51 54 40	63 41 40 27 25 21 57 34 36 26	42 27 27 18 16 14 38 23 24 18	32 21 20 13 12 10 28 17 18 13	25 16 16 11 10 8 23 14 15 11	144.2 96 110.6 72.7 66.8 62.3 80 36 85 40	72.1 40 55.3 36.3 33.4 31.1 40 18 42 20	119.2 78 76.2 50.7 46.5 39.1 80 36 68 40	59.6 39 38.1 25.4 23.3 19.6 40 18 34 20
23	12 JP 12 12 JP 14* 10 JP 14 10 JP 14 10 JP 15 9 JP 14 8 JP 14 12 CP 12 EWF 12 CP 14 EWF 10 CP 12 EWF	2888 1878 2216 1456 1339 1248 1051 2061 817 1990	251 163 193 127 116 109 91 179 71 173 86	188 123 145 95 87 81 69 134 53 130 65	126 82 96 63 58 54 46 90 36 87	84 54 64 42 39 36 31 60 24 58 29	63 41 48 32 29 27 23 45 18 43 22	50 33 39 25 23 22 18 36 14 35	143 93 92 61 56 47 35 128 71 82 60	107 70 69 46 42 35 26 96 53 62 45	72 47 46 31 28 24 18 64 36 41 30	48 31 31 20 19 16 12 43 24 27 20	36 23 23 15 14 12 9 32 18 21 15	29 19 18 12 11 9 7 26 14 16 12	157 100 120.4 79.1 72.8 67.8 57.1 84 38 88 41	78.5 42 60.2 39.6 36.4 33.9 28.6 42 19 44 21	135.4 84 86.6 57.6 52.8 44.4 33.3 84 38 78 41	67.7 42 43.3 28.8 26.4 22.2 16.6 42 19 39 21
22	10 CP 14 EWF  12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 14 12 CP 12 EWF 12 CP 12 EWF 10 CP 12 EWF 10 CP 14 EWF	993 3020 1963 2317 1552 1400 1305 965 1099 2061 817 2081 993	275 178 211 138 127 119 88 100 187 74 189 90	206 134 158 104 96 89 66 75 141 56 142 68	137 89 105 69 64 59 44 50 94 37 95 45	92 60 70 46 42 40 29 33 63 25 63 30	69 45 53 35 32 30 22 25 47 19 47 23	55 36 42 28 26 24 18 20 38 15 38 18	164 106 105 70 64 54 39 40 147 74 94 68	123 80 79 52 48 40 29 30 110 56 70 51	82 53 52 35 32 27 20 20 73 37 47 34	55 36 35 23 21 18 13 13 49 25 31 23	41 27 26 17 16 13 10 10 37 19 24 17	33 21 21 14 13 11 8 8 29 15 19	169.8 105 131.6 86.5 79.5 74.1 54.8 62.4 88 40 92 43	84.9 44 65.8 43.3 39.8 37.1 27.4 31.2 44 20 46 22	154.7 88 98.9 65.8 60.4 50.8 37.1 38.0 88 40 89 43	77.4 44 49.5 32.9 30.2 25.4 18.5 19.0 44 20 44 22

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TABLE 1 ALLOWABLE UNIFORM LOADS FOR JOISTS IN LBS. PER SQ. FT. (cont.)

	LE 1 AL				SIMPLI	E SPAN	1				SIMPL	E SPA	N		3 SE		ONDITI	
SPAN	CECTION	ONE END REACTION	12"	16"	TOTAL 24"	LOAD	48"	60"	12"	16"	24"	36"	48"	60"	24"	48"	24"	LOAD
21	SECTION  12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 14 12 CP 12 EWF 12 CP 12 EWF 10 CP 12 EWF	3163 2057 2427 1595 1467 1367 1011 1151 2061 817 2180 993	301 196 231 152 140 130 96 110 196 78 208 95	226 147 173 114 105 98 72 82 147 58 156 71	151 98 116 76 70 65 48 55 98 39 104 47	100 65 77 51 47 43 32 37 65 26 69 32	75 49 58 38 35 33 24 27 49 20 52 24	60 39 46 30 28 26 19 22 39 16 42 19	188 122 120 80 73 62 45 46 169 78 108 79	141 92 90 60 55 46 34 35 126 58 81 59	94 61 60 40 37 31 23 23 84 39 54	63 41 40 27 25 21 15 15 56 26 36 26	47 31 30 20 18 15 11 12 42 20 27 20	38 25 24 16 15 12 9 9 34 16 22 16	177.9 110 144.5 94.9 87.3 81.4 60.2 68.5 92 42 97 45	89.0 46 72.2 47.5 43.6 40.7 30.1 34.3 46 21 48 23	177.9 92 113.7 75.7 69.4 58.4 42.6 43.7 92 42 97 45	88.9 46 56.9 37.9 34.7 29.2 21.3 21.9 46 21 48 23
20	12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 16 12 CP 12 EWF 12 CP 14 EWF 10 CP 12 EWF 10 CP 14 EWF 8 CP 14 EWF	3322 2160 2549 1675 1540 1435 1061 1209 890 2061 817 2252 993 1169	332 216 255 168 154 144 106 121 89 206 82 225 99 117	249 162 191 126 116 108 80 91 67 155 61 169 75 88	166 108 127 84 77 72 53 60 45 103 41 113 50 58	111 72 85 56 51 48 35 40 30 69 27 75 33 39	83 54 64 42 39 36 27 30 22 52 20 56 25 29	66 43 51 34 31 29 21 24 18 41 16 45 20 23	218 142 139 93 85 72 52 54 39 195 82 125 91 53	163 106 104 70 64 54 39 40 29 146 61 94 68 40	109 71 70 46 43 36 26 27 19 98 41 63 46 27	73 47 46 31 28 24 17 18 13 65 27 42 30 18	54 35 35 23 21 18 13 13 10 49 20 31 23 13	44 25 28 19 17 14 10 11 8 39 16 25 18	186.8 116 159.3 104.7 94.0 89.7 75.5 55.6 96 44 101 48 52	93.4 48 79.6 52.3 47.0 44.9 32.3 37.8 27.8 48 22 51 24 26	186.8 96 131.7 87.6 80.4 67.6 49.4 50.6 36.8 96 44 101 48 50	93.4 48 65.8 43.8 40.2 33.8 24.7 25.3 18.4 48 22 51 24 25
19	12 JP 12 12 JP 14* 10 JP 12 10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 14 8 JP 16 6 JP 14 12 CP 12 EWF 10 CP 12 EWF 10 CP 12 EWF 10 CP 12 EWF 10 CP 14 EWF 8 CP 14 EWF	3496 2274 2683 1763 1621 1511 1117 1272 936 842 2061 817 2252 993 1169	368 239 282 186 171 159 118 134 99 89 217 86 237 105 123	276 180 212 139 128 119 88 100 74 66 163 65 178 78 92	184 120 141 93 85 80 59 67 49 44 109 43 119 52 62	123 80 94 62 57 53 39 45 33 30 72 29 79 35 41	92 60 71 46 43 40 29 34 25 22 54 22 59 26 31	74 48 57 37 34 32 24 27 20 18 43 17 47 21 25	254 165 162 108 99 83 61 62 45 32 217 86 146 105 62	191 124 122 81 74 63 46 47 34 24 163 65 109 78	127 83 81 54 50 42 30 31 23 16 109 43 73 52 31	85 55 54 36 33 28 20 21 15 11 72 29 49 35 21	64 41 41 27 25 21 15 16 11 8 54 22 37 26 16	51 33 33 22 20 17 12 13 9 6 43 17 29 21	196.6 122 176.5 110.5 99.0 99.4 68.1 83.7 61.6 55.4 101 46 107 50 54	98.3 51 88.2 55.3 49.5 49.7 34.0 41.8 30.8 27.7 51 23 53 25 27	196.6 101 153.6 102.2 93.7 78.8 57.6 59.0 42.9 30.1 101 46 107 50 54	98.3 51 76.8 51.1 46.9 39.4 28.8 29.5 21.4 15.0 51 23 53 25 27
18	12 JP 14* 10 JP 12 10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 14 8 JP 16 6 JP 16 12 CP 12 EWF 12 CP 12 EWF 10 CP 12 EWF 10 CP 12 EWF 8 CP 14 EWF 8 CP 14 EWF 8 CP 15 EWF	2304 2832 1861 1711 1595 1179 1343 988 888 641 2061 817 2252 993 1169 900	256 315 207 190 177 131 149 110 99 71 229 91 250 110 130	192 236 155 143 133 98 112 82 74 53 172 68 188 83 97 75	128 157 103 95 89 66 75 55 49 36 115 45 125 55 65	85 105 69 63 59 44 50 37 33 24 76 30 83 37 43 33	64 79 52 48 44 33 37 28 25 18 57 23 63 28 33 25	51 63 41 38 35 26 30 22 20 14 46 18 50 22 26 20	194 191 127 117 98 72 73 53 37 26 229 91 172 110 73 65	146 143 95 87 74 54 55 40 28 20 172 68 129 83 55 49	97 96 64 58 49 36 37 27 19 13 115 45 86 55 37 32	65 64 42 39 33 24 25 18 13 9 76 30 57 37 24 22	49 48 32 29 25 18 18 13 9 7 57 23 43 28 18	39 38 25 23 20 14 15 11 8 5 46 18 34 22 15	128 196.7 116.7 104.5 110.7 71.9 93.3 68.6 61.2 44.5 107 48 113 53 57	54 98.3 58.3 52.2 55.4 35.9 46.6 34.3 30.8 22.3 54 24 56 27 28	107 180.6 116.7 104.5 92.7 67.7 69.4 50.4 35.4 24.5 107 48 113 53 57	54 90.3 58.3 52.2 46.4 33.8 34.7 25.2 17.7 12.3 54 24 56 27 28 23
17	10 JP 12 10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 16 6 JP 16 10 CP 12 EWF 10 CP 14 EWF 8 CP 14 EWF 8 CP 15 EWF	2998 1970 1812 1689 1249 1422 1046 679 2252 993 1169 900	353 232 213 199 147 167 123 80 265 117 138 106	265 174 160 149 110 126 92 60 199 88 103 80	176 116 107 99 74 84 62 40 133 58 69 53	118 77 71 66 49 56 41 27 88 39 46 35	88 58 53 50 37 42 31 20 66 29 34 27	71 46 43 40 29 34 25 16 53 23 28 21	227 151 138 116 85 87 63 31 204 117 87	170 113 104 87 64 65 48 23 153 88 65 58	113 75 69 58 43 44 32 15 102 58 43 39	76 50 46 39 28 29 21 10 68 39 29 26	57 38 35 29 21 22 16 8 51 29 22 19	13 45 30 28 23 17 17 13 6 41 23 17 15	219.8 123.5 110.6 123.5 76.1 104.6 76.9 49.9 119 56 61 48	23 109.9 61.8 55.3 61.8 38.0 52.3 38.5 25.0 60 28 30 24	45 214.4 123.5 110.6 110.1 76.1 82.4 59.9 29.1 119 56 61 48	107.2 61.8 55.3 55.0 38.0 41.2 29.9 14.6 60 28 30 24

NOTE: For Web Crippling see Maximum Allowable Reaction Tables.

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Refer to Design Notes Page 31 and Specifications Page 27

## TABLE 1 ALLOWABLE UNIFORM LOADS FOR JOISTS IN LBS. PER SO. FT. (cont.)

1						SIMPL	E SPAI	N			010	CIMPI	L	00.	PEK	SQ.			
	SPAN	SECTION	ONE END REACTION	12"	16"		LOAD						E SPA LOAD	N		3 S	PAN C	ONDIT	ION
	FT.	10 JP 12	3186	398	299	24"	36"	48"	60"	12"	16"	24"	36"	48"	60"	24"	48"	24"	48"
	16	10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 16 8 JP 16 6 JP 16 10 CP 12 EWF 10 CP 14 EWF 8 CP 14 EWF 8 CP 15 EWF	2093 1925 1794 1327 1511 1112 721 2252 993 1169 900	262 241 224 166 189 139 90 282 124 146 113	196 181 168 124 142 104 68 211 93 110 84	199 131 120 112 83 94 70 45 141 62 73 56	133 87 80 75 55 63 46 30 94 41 49 38	100 65 60 56 42 47 35 23 70 31 37 28	80 52 48 45 33 38 28 18 56 25 29 23	272 181 166 140 102 105 76 37 244 124 104 92	204 136 125 105 76 78 57 28 183 93 78 69	136 90 83 70 51 52 38 19 122 62 52 46	91 60 55 47 34 35 25 12 81 41 35 31	68 45 42 35 26 26 19 9 61 31 26 23	54 36 33 28 20 21 15 7 49 25 21	233.5 131.2 117.5 131.2 80.8 118.0 86.9 56.4 127 60 65 51	116.7 65.6 58.8 65.6 40.4 59.0 43.4 28.2 63 30 32 26	233.5 131.2 117.5 131.2 80.8 98.8 71.8 34.9 127 60 65 51	116.7 65.6 58.8 65.6 40.4 49.4 35.9 17.5 63 30 32 26
	15	10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 16 6 JP 16 6 JP 18 10 CP 12 EWF 10 CP 14 EWF 8 CP 14 EWF 8 CP 15 EWF 6 CP 15 EWF 6 CP 16 EWF	2233 2053 1914 1415 1612 1186 770 406 2252 993 1169 900 970 813	298 274 255 189 215 158 103 54 300 132 156 120 129 108	223 205 191 142 161 119 77 41 225 99 117 90 97 81	149 137 128 94 107 79 51 27 150 66 78 60 65 54	99 91 85 63 72 53 34 18 100 44 52 40 43 36	74 68 64 47 54 40 26 14 75 33 39 30 32 27	60 55 51 38 43 32 21 11 60 27 31 24 26 22	220 201 169 124 127 92 45 36 296 132 126 112 57	165 151 127 93 95 69 34 27 222 99 95 84 43 38	110 101 85 62 63 46 22 18 148 66 63 56 28 25	73 67 57 41 42 31 15 12 99 44 42 37 19	55 50 42 31 32 23 11 9 74 33 32 28 14	44 40 34 25 25 18 9 7 59 27 25 22 11	140.0 125.4 140.0 86.2 134.3 93.6 64.1 33.9 135 64 69 55 60 46	70 62.7 70.0 43.1 67.1 46.8 32.1 16.9 68 32 34 27 30 23	140.0 125.4 140.0 86.2 119.9 87.1 42.4 33.6 135 64 69 55 54 446	70 62.7 70.0 43.1 60.0 43.6 21.2 16.8 68 32 34 27 27 23
	14	10 JP 14 10 JP 15 9 JP 16 8 JP 16 8 JP 16 6 JP 16 6 JP 18 8 CP 14 EWF 8 CP 15 EWF 6 CP 15 EWF 6 CP 16 EWF	2304 2054 2050 1516 1727 1271 825 435 1169 900 1040 813	329 293 293 217 247 182 118 62 167 129 149 116	247 220 220 163 185 136 88 47 125 97 111 87	165 147 147 108 123 91 59 31 84 64 74	110 97 98 72 82 61 39 21 56 43 50 39	82 73 73 54 62 45 29 16 42 32 37 29	66 59 59 43 49 36 24 12 33 26 30 23	270 248 208 152 156 113 55 44 155 129 70 62	203 186 156 114 117 85 41 33 117 97 52 47	135 124 104 76 78 57 28 22 78 64 35 31	90 83 69 51 52 38 18 15 52 43 23 21	68 62 52 38 39 28 14 11 39 32 17 16	54 50 42 30 31 23 11 9 31 26 14	150.0 134.3 150.0 92.4 150.0 100.3 73.6 38.9 74 58 64 49	75.0 67.2 75.0 46.2 75.0 50.1 36.8 19.4 37 29 32 25	150.0 134.3 150.0 92.4 147.5 100.3 52.2 41.3 74 58 64 49	75.0 67.2 75.0 46.2 73.8 50.1 26.1 20.7 37 29 32 25
	13	9 JP 14 9 JP 16 8 JP 14 8 JP 16 6 JP 16 6 JP 18 8 CP 14 EWF 6 CP 15 EWF 6 CP 16 EWF	2208 1552 1859 1368 888 469 1169 1071 813	340 239 286 211 137 72 180 165 125	255 179 215 158 103 54 135 124 94	170 119 143 105 68 36 90 82 63	113 80 95 70 46 24 60 55 42	85 60 72 53 34 18 45 41 31	68 48 57 42 27 15 36 33 25	260 190 195 142 69 55 180 87 78	195 143 146 106 52 41 135 65 58	130 95 97 71 34 27 90 44 39	87 53 65 47 23 18 60 29 26	65 48 49 35 17 14 45 22 19	52 38 39 28 14 11 36 17 16	161.5 99.5 161.5 108.0 85.4 45.1 80 69 53	80.8 49.8 80.8 54.0 42.7 22.5 40 34 27	161.5 99.5 161.5 108.0 65.1 50.2 80 69 53	80.8 49.8 80.8 54.0 32.6 25.1 40 34 27
	12	9 JP 16 8 JP 14 8 JP 16 6 JP 16 6 JP 18 6 CP 15 EWF 6 CP 16 EWF	1552 2014 1482 962 508 1071 813	259 336 247 160 85 179 136	195 252 185 120 64 134 102	129 168 124 80 42 89 68	86 112 82 53 28 60 45	65 84 62 40 21 45 34	52 67 49 32 17 36 27	242 248 180 88 69 111 99	181 186 135 66 52 83 74	121 124 90 44 35 55 49	81 83 60 29 23 37 33	60 62 45 22 17 28 25	48 50 36 18 14 22 20	107.8 175.0 117.0 100.2 52.9 74 58	53.9 87.5 58.5 50.1 26.5 37 29	107.8 175.0 117.0 82.8 54.4 74 58	53.9 87.5 58.5 41.4 27.2 37 29
1	11	8 JP 16 6 JP 16 6 JP 18 6 CP 15 EWF 6 CP 16 EWF	1557 1049 554 1071 813	283 191 101 195 148	212 143 76 146 111	142 95 50 97 74	94 64 34 65 49	71 48 25 49 37	57 38 20 39 30	234 114 90 144 128	175 85 68 108 96	117 57 45 72 64	78 38 30 48 43	58 28 23 36 32	47 23 18 29 26	127.6 119.2 59.3 81 63	63.8 59.6 29.7 41 31	127.6 107.5 59.3 81 63	63.8 53.8 29.7 41 31
	10	8 JP 16 6 JP 16 6 JP 18 6 CP 15 EWF 6 CP 16 EWF	1557 1154 609 1071 813	311 231 122 214 163	234 173 91 161 122	156 115 61 107 81	104 77 41 71 55	78 58 31 54 41	62 46 24 43 33	311 151 120 191 163	233 114 90 143 122	156 76 60 96 81	104 50 40 64 55	78 38 30 48 41	62 30 24 38 33	140.4 144.0 65.2 89 69	70.2 72.0 32.6 45 35	140.4 143.1 65.2 89 69	70.2 71.6 32.6 45 35

NOTE: For Web Crippling see Maximum Allowable Reaction Tables. Note: Refer to Design Notes— Page 31 W-Wide Flange (1%"), N-Narrow Flange (1"), C-Cee Stud & Joist, P-Punched, T-Track, B-Bridging, J-Joist, S-Double Stud, EWF-Extra Wide Flange (2½")

TABLE 2 ALLOWABLE UNIFORM LOADS FOR PUNCHED STUDS IN LBS. PER SO. FT.

			N LE		SIMPLI	E SPAN	V					LE SPA			3 S	PAN C	ONDIT	ION
SPAN FT.	SECTION	ONE END REACTION	12"	16"	TOTAL 24"	LOAD	48"	60"	12"	16"	24"	36"	48"	60"	24"	L LOAD	LIVE 24"	LOAD
30	12 CP 12 12 CP 14*	1540.3 817.1	102.7 54.5	77.0 40.9	51.3 27.2	34.2 18.2	25.7 13.6	20.5	44.9 32.7	33.7 24.5	22.4 16.4	15.0 10.9	11.2 8.2			32.1 14.5	42.4	21.2
29	12 CP 12 12 CP 14 *	1593.4 817.1	109.9 56.3	82.4 42.3	54.9 28.2	36.6 18.8	27.5 14.1	22.0 11.3	49.7 36.2	37.3 27.2	24.8 18.1	16.6 12.1	12.4 9.1	9.9 7.2		33.2 15.0	47.0 30.1	23.5
28	12 CP 12	1650.3	117.9	88.4	58.9	39.3	29.5	23.6	55.2	41.4	27.6	18.4	13.8	11.0	68.8	34.4	52.2	26.1
	12 CP 14*	817.1	58.4	43.8	29.2	19.5	14.6	11.7	40.3	30.2	20.1	13.4	10.1	8.1	31.1	15.6	31.1	15.6
	10 CP 12	1243.1	88.8	66.6	44.4	29.6	22.2	17.8	34.6	26.0	17.3	11.5	8.7	6.9	55.5	27.7	32.8	16.4
27	12 CP 12	1711.4	126.8	95.1	63.4	42.3	31.7	25.4	61.6	46.2	30.8	20.5	15.4	12.3	71.3	35.7	58.2	29.1
	12 CP 14*	817.1	60.5	45.4	30.3	20.2	15.1	12.1	44.9	33.7	22.4	15.0	11.2	9.0	32.3	16.1	32.3	16.1
	10 CP 12	1289.1	95.5	71.6	47.7	31.8	23.9	19.1	38.6	29.0	19.3	12.9	9.7	7.7	59.7	29.8	36.5	18.3
26	12 CP 12	1777.2	136.7	102.5	68.4	45.6	34.2	27.3	68.9	51.7	34.5	23.0	17.2	13.8	74.1	37.0	65.2	32.6
	12 CP 14 *	817.1	62.9	47.1	31.4	21.0	15.7	12.6	50.3	37.7	25.1	16.8	12.6	10.1	33.5	16.8	33.5	16.8
	10 CP 12	1338.7	103.0	77.2	51.5	34.3	25.7	20.6	43.3	32.5	21.6	14.4	10.8	8.7	64.4	32.2	40.9	20.5
	10 CP 14	978.9	75.3	56.5	37.6	25.1	18.8	15.1	31.6	23.7	15.8	10.5	7.9	6.3	36.6	18.3	29.9	15.0
25	12 CP 12	1848.3	147.9	110.9	73.9	49.3	37.0	29.6	77.5	58.2	38.8	25.8	19.4	15.5	77.0	38.5	73.3	36.7
	12 CP 14 *	817.1	65.4	49.0	32.7	21.8	16.3	13.1	56.6	42.4	28.3	18.9	14.1	11.3	34.9	17.4	34.9	17.4
	10 CP 12	1392.2	111.4	83.5	55.7	37.1	27.8	22.3	48.7	36.5	24.3	16.2	12.2	9.7	69.6	34.8	46.0	23.0
	10 CP 14	993.0	79.4	59.6	39.7	26.5	19.9	15.9	35.6	26.7	17.8	11.9	8.9	7.1	38.1	19.0	33.7	16.8
24	12 CP 12	1925.3	160.4	120.3	80.2	53.5	40.1	32.1	87.7	65.7	43.8	29.2	21.9	17.5	80.2	40.1	80.2	40.1
	12 CP 14 *	817.1	68.1	51.1	34.0	22.7	17.0	13.6	63.9	47.9	32.0	21.3	16.0	12.8	36.3	18.2	36.3	18.2
	10 CP 12	1450.2	120.9	90.6	60.4	40.3	30.2	24.2	55.0	41.3	27.5	18.3	13.8	11.0	75.5	37.8	52.0	26.0
	10 CP 14	993.0	82.8	62.1	41.4	27.6	20.7	16.6	40.2	30.2	20.1	13.4	10.1	8.0	39.7	19.8	38.0	19.0
	10 CP 15	730.1	60.8	45.6	30.4	20.3	15.2	12.2	36.5	27.3	18.2	12.2	9.1	7.3	30.9	15.5	30.9	15.5
23	12 CP 12	2009.0	174.7	131.0	87.3	58.2	43.7	34.9	99.6	74.7	49.8	33.2	24.9	19.9	83.7	41.9	83.7	41.9
	12 CP 14 *	817.1	71.0	53.3	35.5	23.7	17.8	14.2	71.0	53.3	35.5	23.7	17.8	14.2	37.9	18.9	37.9	18.9
	10 CP 12	1513.3	131.6	98.7	65.8	43.9	32.9	26.3	62.5	46.9	31.3	20.8	15.6	12.5	82.2	41.1	59.1	29.6
	10 CP 14	993.0	86.3	64.8	43.2	28.8	21.6	17.3	45.7	34.3	22.9	15.2	11.4	9.1	41.4	20.7	41.4	20.7
	10 CP 15	730.1	63.5	47.6	31.7	21.2	15.9	12.7	41.4	31.1	20.7	13.8	10.4	8.3	32.2	16.1	32.2	16.1
	8 CP 14	790.4	68.7	51.5	34.4	22.9	17.2	13.7	26.1	19.6	13.1	8.7	6.5	5.2	43.0	21.5	24.7	12.4
22	12 CP 12	2061.2	187.4	140.5	93.7	62.5	46.8	37.5	113.8	85.3	56.9	37.9	28.4	22.8	87.5	43.8	87.5	43.8
	12 CP 14 *	817.1	74.3	55.7	37.1	24.8	18.6	14.9	74.3	55.7	37.1	24.8	18.6	14.9	39.6	19.8	39.6	19.8
	10 CP 12	1582.1	143.8	107.9	71.9	47.9	36.0	28.8	71.4	53.6	35.7	23.8	17.9	14.3	89.9	44.9	67.6	33.8
	10 CP 14	993.0	90.3	67.7	45.1	30.1	22.6	18.1	52.2	39.2	26.1	17.4	13.1	10.4	43.3	21.6	43.3	21.6
	10 CP 15	730.1	66.4	49.8	33.2	22.1	16.6	13.3	47.3	35.5	23.7	15.8	11.8	9.5	33.7	16.9	33.7	16.9
	8 CP 14	826.3	75.1	56.3	37.6	25.0	18.8	15.0	29.8	22.4	14.9	9.9	7.5	6.0	47.0	23.5	28.2	14.1
	8 CP 15	749.4	68.1	51.1	34.1	22.7	17.0	13.6	27.1	20.3	13.5	9.0	6.8	5.4	37.1	18.6	25.6	12.8
	8 CP 16	649.6	59.1	44.3	29.5	19.7	14.8	11.8	24.2	18.2	12.1	8.1	6.1	4.8	28.2	14.1	22.9	11.4
21	12 CP 12	2061.2	196.3	147.2	98.2	65.4	49.1	39.3	130.8	98.1	65.4	43.6	32.7	26.2	91.7	45.9	91.7	45.9
	12 CP 14 *	817.1	77.8	58.4	38.9	25.9	19.5	15.6	77.8	58.4	38.9	25.9	19.5	15.6	41.5	20.8	41.5	20.8
	10 CP 12	1657.4	157.8	118.4	78.9	52.6	39.5	31.6	82.1	61.6	41.1	27.4	20.5	16.4	96.5	48.3	77.7	38.8
	10 CP 14	993.0	94.6	70.9	47.3	31.5	23.6	18.9	60.1	45.0	30.0	20.0	15.0	12.0	45.3	22.7	45.3	22.7
	10 CP 15	730.1	69.5	52.1	34.8	23.2	17.4	13.9	54.4	40.8	27.2	18.1	13.6	10.9	35.3	17.7	35.3	17.7
	8 CP 14	865.7	82.4	61.8	41.2	27.5	20.6	16.5	34.3	25.7	17.2	11.4	8.6	6.9	49.2	24.6	32.5	16.2
	8 CP 15	785.1	74.8	56.1	37.4	24.9	18.7	15.0	31.1	23.3	15.6	10.4	7.8	6.2	38.9	19.5	29.4	14.7
	8 CP 16	649.6	61.9	46.4	30.9	20.6	15.5	12.4	27.8	20.9	13.9	9.3	7.0	5.6	29.6	14.8	26.3	13.2
20	12 CP 12	2061.2	206.1	154.6	103.1	68.7	51.5	41.2	151.5	113.6	75.7	50.5	37.9	30.3	96.3	48.1	96.3	48.1
	12 CP 14 *	817.1	81.7	61.3	40.9	27.2	20.4	16.3	81.7	61.3	40.9	27.2	20.4	16.3	43.6	21.8	43.6	21.8
	10 CP 12	1740.3	174.0	130.5	87.0	58.0	43.5	34.8	95.1	71.3	47.5	31.7	23.8	19.0	101.3	50.7	89.9	45.0
	10 CP 14	993.0	99.3	74.5	49.7	33.1	24.8	19.9	69.5	52.1	34.8	23.2	17.4	13.9	47.6	23.8	47.6	23.8
	10 CP 15	730.1	73.0	54.8	36.5	24.3	18.3	14.6	63.0	47.2	31.5	21.0	15.7	12.6	37.1	18.5	37.1	18.5
	8 CP 14	909.0	90.9	68.2	45.4	30.3	22.7	18.2	39.7	29.8	19.9	13.2	9.9	7.9	51.6	25.8	37.6	18.8
	8 CP 15	824.4	82.4	61.8	41.2	27.5	20.6	16.5	36.0	27.0	18.0	12.0	9.0	7.2	40.9	20.4	34.1	17.0
	8 CP 16	649.6	65.0	48.7	32.5	21.7	16.2	13.0	32.2	24.2	16.1	10.7	8.1	6.4	31.1	15.5	30.5	15.2
19	12 CP 12 12 CP 14 * 10 CP 12 10 CP 14 10 CP 15 8 CP 14 8 CP 15 8 CP 16	2061.2 817.1 1831.9 993.0 730.1 956.8 867.8 649.6	217.0 86.0 192.8 104.5 76.9 100.7 91.3 68.4	162.7 64.5 144.6 78.4 57.6 75.5 68.5 51.3	108.5 43.0 96.4 52.3 38.4 50.4 45.7 34.2	72.3 28.7 64.3 34.8 25.6 33.6 30.4 22.8	54.2 21.5 48.2 26.1 19.2 25.2 22.8 17.1	43.4 17.2 38.6 20.9 15.4 20.1 18.3 13.7	176.7 86.0 110.9 81.1 73.5 46.3 42.0 37.6	132.5 64.5 83.2 60.8 55.1 34.8 31.5 28.2	88.3 43.0 55.4 40.5 36.7 23.2 21.0 18.8	58.9 28.7 37.0 27.0 24.5 15.4 14.0 12.5	44.2 21.5 27.7 20.3 18.4 11.6 10.5 9.4	35.3 17.2 22.2 16.2 14.7 9.3 8.4	101.4 45.9 106.7 50.1 39.0 54.4 43.0	50.7 22.9 53.3 25.1 19.5 27.2 21.5	101.4 45.9 104.9 50.1 39.0 43.8 39.7 32.7	50.7 22.9 52.4 25.1 19.5 21.9 19.9 16.3
18	12 CP 12 12 CP 14 * 10 CP 12 10 CP 14 10 CP 15 8 CP 14 8 CP 15 8 CP 16	2061.2 817.1 1933.6 993.0 730.1 1010.0 900.5 649.6	229.0 90.8 214.8 110.3 81.1 112.2 100.1 72.2	171.8 68.1 161.1 82.8 60.8 84.2 75.0 54.1	114.5 45.4 107.4 55.2 40.6 56.1 50.0 36.1	76.3 30.3 71.6 36.8 27.0 37.4 33.4 24.1	57.3 22.7 53.7 27.6 20.3 28.1 25.0 18.0	45.8 18.2 43.0 22.1 16.2 22.4 20.0 14.4	207.8 90.8 130.4 95.4 81.1 54.5 49.4 44.2	155.8 68.1 97.8 71.5 60.8 40.9 37.1 33.2	103.9 45.4 65.2 47.7 40.6 27.2 24.7 22.1	69.3 30.3 43.5 31.8 27.0 18.2 16.5	51.9 22.7 32.6 23.8 20.3 13.6 12.4 11.1	7.5 41.6 18.2 26.1 19.1 16.2 10.9 9.9 8.8	32.7 107.0 48.4 112.6 52.9 41.2 57.4 45.4 34.5	24.2 56.3 26.5 20.6 28.7 22.7	07.0 48.4 12.6 52.9 41.2 51.5 45.4 34.5	53.5 24.2 56.3 26.5 20.6 25.8 22.7 17.3
17 NOTE:	12 CP 14 * 10 CP 12 10 CP 14 10 CP 15 For Web Cripplin	817.1 2047.4 993.0 730.1 ng see Maximu	96.1 240.9 116.8 85.9 um Allow	72.1 180.7 87.6 64.4	48.1 120.4 58.4 42.9 action Ta	32.0 80.3 38.9 28.6 bles.	24.0 60.2 29.2 21.5 Note:	19.2 48.2 23.4 17.2	96.1 154.8 113.2 85.9	72.1 116.1 84.9 64.4 lotes—P	48.1 77.4 56.6	32.0 51.6 37.7 28.6	24.0 38.7 28.3 21.5 /t> 150	19.2 31.0 22.6 17.2	51.3 119.2 56.0 43.6	25.6 59.6 28.0	51.3 19.2 56.0 43.6	25.6 59.6 28.0 21.8

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## TABLE 2 ALLOWABLE UNIFORM LOADS FOR PUNCHED STUDS IN LBS. PER SQ. FT. (cont.)

-	SPAN		ONE END			TOTAL	SPAN				:	SIMPLI	E SPAN LOAD			3 SP	AN CO		
	FT.	SECTION	REACTION	12"	16"	24"	36"	48"	60"	12"	16"	24"	36"	48"	60"	24"	48"	24"	48"
-	17	8 CP 14 8 CP 15 8 CP 16 6 CP 15 6 CP 16	1069.4 900.5 649.6 634.3 568.1	125.8 105.9 76.4 74.6 66.8	94.4 79.5 57.3 56.0 50.1	62.9 53.0 38.2 37.3 33.4	41.9 35.3 25.5 24.9 22.3	31.5 26.5 19.1 18.7 16.7	25.2 21.2 15.3 14.9 13.4	64.7 58.7 52.5 28.8 25.8	48.5 44.0 39.4 21.6 19.3	32.3 29.3 26.2 14.4 12.9	21.6 19.6 17.5 9.6 8.6	16.2 14.7 13.1 7.2 6.4	12.9 11.7 10.5 5.8 5.2	60.8 48.1 36.5 46.6 40.7	30.4 24.0 18.3 23.3 20.3	60.8 48.1 36.5 27.2 24.4	30.4 24.0 18.3 13.6 12.2
	16	10 CP 15 8 CP 14 8 CP 15 8 CP 16 6 CP 15 6 CP 16 6 CP 18 6 NP 16	730.1 1136.2 900.5 649.6 674.0 603.6 325.8 341.5	91.3 142.0 112.6 81.2 84.2 75.5 40.7 42.7	68.4 106.5 84.4 60.9 63.2 56.6 30.5 32.0	45.6 71.0 56.3 40.6 42.1 37.7 20.4 21.3	30.4 47.3 37.5 27.1 28.1 25.2 13.6 14.2	22.8 35.5 28.1 20.3 21.1 18.9 10.2 10.7	18.3 28.4 22.5 16.2 16.8 15.1 8.1 8.5	91.3 77.6 70.4 62.9 34.5 30.9 25.0 20.5	68.4 58.2 52.8 47.2 25.9 23.2 18.8 15.4	45.6 38.8 35.2 31.5 17.3 15.5 12.5 10.2	30.4 25.9 23.5 21.0 11.5 10.3 8.3 6.8	22.8 19.4 17.6 15.7 8.6 7.7 6.3 5.1	18.3 15.5 14.1 12.6 6.9 6.2 5.0 4.1	46.4 64.6 51.1 38.8 52.7 43.2 19.4 26.7	23.2 32.3 25.5 19.4 26.3 21.6 9.7 13.3	46.4 64.6 51.1 38.8 32.6 29.2 19.4 19.4	23.2 32.3 25.5 19.4 16.3 14.6 9.7 9.7
	15	10 CP 15 8 CP 14 8 CP 15 8 CP 16 6 CP 15 6 CP 16 6 CP 18 6 NP 16 4 SP 15	730.1 1169.0 900.5 649.6 718.9 643.9 347.5 364.3 537.1	97.3 155.9 120.1 86.6 95.9 85.9 46.3 48.6 71.6	73.0 116.9 90.0 65.0 71.9 64.4 34.7 36.4 53.7	48.7 77.9 60.0 43.3 47.9 42.9 23.2 24.3 35.8	32.4 52.0 40.0 28.9 32.0 28.6 15.4 16.2 23.9	24.3 39.0 30.0 21.7 24.0 21.5 11.6 12.1 17.9	19.5 31.2 24.0 17.3 19.2 17.2 9.3 9.7 14.3	97.3 94.2 85.4 76.4 41.9 37.5 30.4 24.9 21.1	73.0 70.6 64.1 57.3 31.4 28.1 22.8 18.6 15.8	48.7 47.1 42.7 38.2 20.9 18.8 15.2 12.4 10.5	32.4 31.4 28.5 25.5 14.0 12.5 10.1 8.3 7.0	24.3 23.5 21.4 19.1 10.5 9.4 7.6 6.2 5.3	19.5 18.8 17.1 15.3 8.4 7.5 6.1 5.0 4.2	49.4 68.9 54.5 41.4 59.5 46.1 20.6 30.4 44.8	24.7 34.4 27.2 20.7 29.8 23.0 10.3 15.2 22.4	49.4 68.9 54.5 41.4 39.6 35.5 20.6 23.5 19.9	24.7 34.4 27.2 20.7 19.8 17.7 10.3 11.8 10.0
	14	8 CP 16 6 CP 15 6 CP 16 6 CP 18 6 NP 16 4 SP 15 4 SP 16 362 SP 15 362 SP 16	649.6 770.2 689.9 355.3 390.3 575.5 450.4 496.0 386.5	92.8 110.0 98.6 50.8 55.8 82.2 64.3 70.9 55.2	69.6 82.5 73.9 38.1 41.8 61.7 48.3 53.1 41.4	46.4 55.0 49.3 25.4 27.9 41.1 32.2 35.4 27.6	30.9 36.7 32.9 16.9 18.6 27.4 21.4 23.6 18.4	23.2 27.5 24.6 12.7 13.9 20.6 16.1 17.7 13.8	18.6 22.0 19.7 10.2 11.2 16.4 12.9 14.2 11.0	92.8 51.5 46.1 37.4 30.6 25.9 20.1 20.2 15.6	69.6 38.6 34.6 28.0 22.9 19.4 15.1 15.2 11.7	46.4 25.8 23.1 18.7 15.3 13.0 10.0 10.1 7.8	30.9 17.2 15.4 12.5 10.2 8.6 6.7 6.7 5.2	23.2 12.9 11.5 9.3 7.6 6.5 5.0 5.1 3.9	18.6 10.3 9.2 7.5 6.1 5.2 4.0 4.0 3.1	44.4 63.8 49.4 22.1 34.8 51.4 40.2 44.3 34.5	22.2 31.9 24.7 11.1 17.4 25.7 20.1 22.1 17.3	44.4 48.7 43.6 22.1 28.9 24.5 19.0 19.2 14.8	22.2 24.4 21.8 11.1 14.5 12.3 9.5 9.6 7.4
	13	6 CP 15 6 CP 16 6 CP 18 6 NP 16 6 NP 18 4 SP 15 4 SP 16 362 SP 15 362 SP 16	829.5 742.9 355.3 420.3 220.5 619.8 485.1 534.2 416.2	127.6 114.3 54.7 64.7 33.9 95.3 74.6 82.2 64.0	95.7 85.7 41.0 48.5 25.4 71.5 56.0 61.6 48.0	63.8 57.1 27.3 32.3 17.0 47.7 37.3 41.1 32.0	42.5 38.1 18.2 21.6 11.3 31.8 24.9 27.4 21.3	31.9 28.6 13.7 16.2 8.5 23.8 18.7 20.5 16.0	25.5 22.9 10.9 12.9 6.8 19.1 14.9 16.4 12.8	64.4 57.6 46.7 38.2 30.8 32.4 25.1 25.3 19.5	48.3 43.2 35.0 28.6 23.1 24.3 18.8 19.0 14.6	32.2 28.8 23.3 19.1 15.4 16.2 12.5 12.6 9.8	21.5 19.2 15.6 12.7 10.3 10.8 8.4 8.4 6.5	16.1 14.4 11.7 9.5 7.7 8.1 6.3 6.3 4.9	12.9 11.5 9.3 7.6 6.2 6.5 5.0 5.1 3.9	68.7 53.2 23.8 40.4 21.2 59.6 46.6 51.4 40.0	34.3 26.6 11.9 20.2 10.6 29.8 23.3 25.7 20.0	60.9 53.2 23.8 36.1 21.2 30.6 23.7 23.9 18.4	30.4 26.6 11.9 18.1 10.6 15.3 11.9 12.0 9.2
	12	6 CP 15 6 CP 16 6 CP 18 4 CP 16 6 NP 16 6 NP 18 4 SP 15 4 SP 16 362 SP 15	898.6 804.8 355.3 469.1 455.4 238.9 671.4 525.5 578.7	149.8 134.1 59.2 78.2 75.9 39.8 111.9 87.6 96.5 75.2	112.3 100.6 44.4 58.6 56.9 29.9 83.9 65.7 72.3 56.4	74.9 67.1 29.6 39.1 37.9 19.9 55.9 43.8 48.2 37.6	49.9 44.7 19.7 26.1 25.3 13.3 37.3 29.2 32.2 25.1	37.4 33.5 14.8 19.5 19.0 10.0 28.0 21.9 24.1 18.8	30.0 26.8 11.8 15.6 15.2 8.0 22.4 17.5 19.3 15.0	81.8 73.3 59.2 28.5 48.5 39.2 41.2 31.9 32.2 24.8	61.4 55.0 44.4 21.4 36.4 29.4 30.9 23.9 24.1 18.6	40.9 36.6 29.6 14.2 24.3 19.6 20.6 15.9 16.1 12.4	27.3 24.4 19.7 9.5 16.2 13.1 13.7 10.6 10.7 8.3	20.5 18.3 14.8 7.1 12.1 9.8 10.3 8.0 6.2	16.4 14.7 11.8 5.7 9.7 7.8 8.2 6.4 6.4 5.0	74.4 57.6 25.8 48.9 47.4 24.9 69.9 54.7 60.3 47.0	37.2 28.8 12.9 24.4 23.7 12.4 35.0 27.4 30.1 23.5	74.4 57.6 25.8 26.9 45.9 24.9 38.9 30.2 30.4 23.5	37.2 28.8 12.9 13.5 23.0 12.4 19.5 15.1 15.2 11.7
	11	6 CP 16 6 CP 18 4 CP 18 4 CP 18 6 NP 16 6 NP 18 4 SP 15 4 SP 16 362 SP 15	813.0 355.3 511.7 277.0 496.8 260.6 732.4 573.3 631.3	147.8 64.6 93.0 50.4 90.3 47.4 133.2 104.2 114.8	110.9 48.4 69.8 37.8 67.7 35.5 99.9 78.2 86.1	73.9 32.3 46.5 25.2 45.2 23.7 66.6 52.1 57.4 44.7	49.3 21.5 31.0 16.8 30.1 15.8 44.4 34.7 38.3 29.8	37.0 16.1 23.3 12.6 22.6 11.8 33.3 26.1 28.7 22.4	29.6 12.9 18.6 10.1 18.1 9.5 26.6 20.8 23.0 17.9	95.1 64.6 37.0 30.0 63.0 47.4 53.4 41.4 41.7 32.2	71.4 48.4 27.7 22.5 47.3 35.5 40.1 31.1 31.3 24.2	47.6 32.3 18.5 15.0 31.5 23.7 26.7 20.7 20.9 16.1	31.7 21.5 12.3 10.0 21.0 15.8 17.8 13.8 13.9 10.7	23.8 16.1 9.2 7.5 15.8 11.8 13.4 10.4 8.1	19.0 12.9 7.4 6.0 12.6 9.5 10.7 8.3 8.3 6.4	62.8 28.2 58.1 31.5 56.4 28.2 83.2 65.1 71.7 55.9	31.4 14.1 29.1 15.7 28.2 14.1 41.6 32.6 35.9 27.9	62.8 28.2 35.0 28.4 56.4 28.2 50.5 39.2 39.5 30.5	14.1 17.5 14.2 28.2 14.1 25.3 19.6 19.7 15.2
	10	362 SP 16  4 CP 14 4 CP 15 6 CP 18 4 CP 16 4 CP 18 362 CP 14 362 CP 15 6 NP 16 6 NP 16 4 NP 16 4 SP 15 4 SP 16 4 SP 18 362 SP 15 362 SP 16	491.9 689.6 627.3 355.3 562.9 304.7 602.1 548.0 546.4 286.6 303.6 805.7 630.6 325.3 694.4 541.1	89.4 172.4 125.5 71.1 112.6 60.9 120.4 109.6 109.3 57.3 60.7 161.1 126.1 65.1 138.9		86.2 62.7 35.5 56.3 30.5 60.2 54.8 54.6 28.7 30.4 80.6 63.1 32.5 69.4 54.1 26.8	57.5 41.8 23.7 37.5 20.3 40.1 36.5 36.4 19.1 20.2 53.7 42.0 21.7 46.3 36.1 17.8	43.1 31.4 17.8 28.1 15.2 30.1 27.4 27.3 14.3 15.2 40.3 31.5 16.3 34.7 27.1 13.4	34.5 25.1 14.2 22.5 12.2 24.1 21.9 21.9 11.5 12.1 32.2 25.2 13.0 27.8 21.6 10.7	114.0 54.8 71.1 49.2 39.9 47.7 43.4 83.9 57.3 31.1 71.1 55.1 42.6 55.6 42.9 37.3	85.5 41.1 53.3 36.9 30.0 35.8 32.6 62.9 43.0 23.3 53.4 41.3 32.0 41.7 32.1 28.0	57.1 27.4 35.5 24.6 20.0 23.8 21.7 41.9 28.7 15.5 35.6 27.6 21.3 27.8 18.7	38.0 18.3 23.7 16.4 13.3 15.9 14.5 28.0 19.1 10.4 23.7 18.4 14.2 18.5 14.3 12.4	13.7 17.8 12.3 10.0 11.9 10.9 21.0 14.3 7.8 17.8 13.8 10.7 13.9 10.7 9.3	11.0 14.2 9.8 8.0 9.5 8.7 16.8 11.5 6.2 14.2 11.0 8.5 11.1 8.6 7.5	78.4 31.0 70.4 35.5 75.3 68.5 68.3 31.0 37.9 100.7 78.8 40.7 86.8 67.6 33.4	39.2 15.5 35.2 17.8 37.6 34.3 34.2 15.5 19.0 50.4 39.4 20.3 43.4 33.8 16.7	33.4	15.1 14. 33. 26. 20. 26. 20. 16.

TABLE 2 ALLOWABLE UNIFORM LOADS FOR PUNCHED STUDS IN LBS. PER SQ. FT. (cont.)

						SQ.					SIMPL	E SPA LOAD	N		3 SI TOTA	PAN C	ONDIT	ION	
SPAN FT.	SECTION	ONE END REACTION	12"	16"	24"	36"	48"	60"	12"	16"	24"	36"	48"	60"	24"	48"	24"	48"	-
9	4 CP 14 4 CP 15 6 CP 18 4 CP 16 4 CP 18 362 CP 14 362 CP 15 6 NP 16 4 NP 16 4 NP 16 4 SP 15 4 SP 16 4 SP 18 362 SP 16 362 SP 16	766.2 697.0 355.3 625.4 338.5 669.0 608.9 607.1 318.5 337.3 895.2 700.7 361.4 771.6 601.2 297.3	170.3 154.9 78.9 139.0 75.2 148.7 135.3 134.9 70.8 75.0 198.9 155.7 80.3 171.5 133.6 66.1	127.7 116.2 59.2 104.2 56.4 111.5 101.2 53.1 56.2 149.2 116.8 60.2 128.6 100.2 49.5	85.1 77.4 39.5 69.5 37.6 74.3 67.7 67.5 35.4 37.5 99.5 77.9 40.2 85.7 66.8 33.0	56.8 51.6 26.3 46.3 25.1 49.6 45.1 45.0 23.6 25.0 66.3 51.9 26.8 57.2 44.5	42.6 38.7 19.7 34.7 18.8 37.2 33.8 33.7 17.7 18.7 49.7 38.9 20.1 42.9 33.4 16.5	34.1 31.0 15.8 27.8 15.0 29.7 27.1 27.0 14.2 15.0 39.8 31.1 16.1 34.3 26.7 13.2	82.7 75.2 78.9 67.5 54.8 65.4 59.5 115.1 70.8 42.6 97.6 75.6 58.5 76.2 58.8 51.2	62.0 56.4 59.2 50.6 41.1 49.1 49.1 32.0 73.2 56.7 43.9 57.2 44.1 38.4	41.3 37.6 39.5 33.7 27.4 32.7 29.8 57.5 35.4 21.3 48.8 37.8 29.2 38.1 29.4 25.6	27.6 25.1 26.3 22.5 18.3 21.8 19.8 38.4 23.6 14.2 32.5 25.2 19.5 25.4 19.6 17.1	20.7 18.8 19.7 16.9 13.7 16.4 14.9 28.8 17.7 10.7 24.4 18.9 14.6 19.1 14.7	16.5 15.0 15.8 13.5 11.0 13.1 11.9 23.0 14.2 8.5 19.5 15.1 11.7 15.2 11.8	106.4 96.8 34.4 84.6 39.5 92.9 84.6 76.8 34.4 46.8 124.3 97.3 50.2 107.2 83.5 41.3	53.2 48.4 17.2 42.3 19.7 46.5 47.3 38.4 17.2 23.4 62.2 48.7 25.1 53.6 41.8 20.6	78.2 71.1 34.4 63.8 39.5 61.9 56.3 76.8 34.4 40.3 92.2 71.5 50.2 72.1 55.6 41.3	39.1 35.6 17.2 31.9 19.7 30.9 28.2 38.4 17.2 20.1 46.1 35.8 25.1 36.0 27.8 20.6	,
8	4 CP 14 4 CP 15 4 CP 16 4 CP 18 362 CP 14 362 CP 15 6 NP 18 4 NP 16 4 NP 18 4 SP 18 362 SP 15 362 SP 16 362 SP 18	862.0 784.2 703.6 380.8 752.6 685.0 355.3 379.4 199.7 788.3 406.6 868.1 676.4 334.4	215.5 196.0 175.9 95.2 188.1 171.3 88.8 94.9 197.1 101.6 217.0 169.1 83.6	161.6 147.0 131.9 71.4 141.1 128.4 66.6 71.1 37.4 147.8 76.2 162.8 126.8 62.7	107.7 98.0 88.0 47.6 94.1 85.6 44.4 47.4 25.0 98.5 50.8 108.5 84.5	71.8 65.3 58.6 31.7 62.7 57.1 29.6 31.6 16.6 65.7 33.9 72.3 56.4 27.9	53.9 49.0 44.0 23.8 47.0 42.8 22.2 23.7 12.5 49.3 25.4 54.3 42.3 20.9	43.1 39.2 35.2 19.0 37.6 34.3 17.8 19.0 10.0 39.4 20.3 43.4 33.8 16.7	117.7 107.2 96.1 78.0 93.1 84.8 88.8 60.7 49.1 107.7 83.3 108.5 83.7 72.9	88.3 80.3 72.1 58.5 69.9 63.6 66.6 45.5 36.8 80.7 62.5 81.4 62.8 54.6	58.9 53.5 48.0 39.0 46.6 42.4 44.4 30.3 24.6 53.8 41.6 54.3 41.9 36.4	39.2 35.7 32.0 26.0 31.0 28.3 29.6 20.2 16.4 35.9 27.8 36.2 27.9 24.3	29.4 26.8 24.0 19.5 23.3 21.2 22.2 15.2 12.3 26.9 20.8 27.1 20.9 18.2	23.5 21.4 19.2 15.6 18.6 17.0 17.8 12.1 9.8 21.5 16.7 21.7 16.7	134.7 121.0 95.2 44.4 117.6 107.0 38.7 59.3 31.2 123.2	67.3 60.5 47.6 22.2 58.8 53.5 19.4 29.6 61.6	111.3 101.3 90.9 44.4 88.1 80.2 38.7 57.4 31.2 101.8	55.7 50.6 45.4 22.2 44.0 40.1 19.4 28.7 15.6 50.9	
7	4 CP 14 4 CP 15 4 CP 18 362 CP 14 362 CP 15 4 NP 16 4 NP 18 362 NP 16 362 NP 18 362 SP 18 250 SP 18 250 SP 20	985.1 896.2 435.2 860.1 782.9 433.6 288.2 374.2 197.1 464.7 382.2 232.1 166.4	281.5 256.0 124.3 245.7 223.7 123.9 65.2 106.9 56.3 132.8 109.2 66.3 47.5	211.1 192.0 93.3 184.3 167.8 92.9 48.9 80.2 42.2 99.6 81.9 49.7 35.7	140.7 128.0 62.2 122.9 111.8 61.9 32.6 53.5 28.2 66.4 54.6 33.2 23.8	93.8 85.3 41.4 81.9 74.6 41.3 21.7 35.6 18.8 44.3 36.4 22.1 15.8	70.4 64.0 31.1 61.4 55.9 31.0 16.3 26.7 14.1 33.2 27.3 16.6 11.9	56.3 51.2 24.9 49.1 44.7 24.8 13.0 21.4 11.3 26.6 21.8 13.3 9.5	175.7 159.9 116.5 139.0 126.6 90.6 65.2 70.8 57.4 124.3 108.8 38.8 28.9	131.8 119.9 87.3 104.3 94.9 67.9 48.9 53.1 43.1 93.2 81.6 29.1 21.7	87.9 79.9 58.2 69.5 63.3 45.3 32.6 35.4 28.7 62.2 54.4 19.4	58.6 53.3 38.8 46.3 42.2 30.2 21.7 23.6 19.1 41.4 36.3 12.9 9.6	43.9 40.0 29.1 34.8 31.6 22.6 16.3 17.7 14.4 31.1 27.2 9.7 7.2	35.1 32.0 23.3 27.8 25.3 18.1 13.0 14.2 11.5 24.9 21.8 7.8 5.8	170.6 138.3 153.6 139.8	85.3 69.2 76.8 69.9	166.2 138.3 131.5 119.7	83.1 69.2 65.7 59.8	
6	4 CP 14 4 CP 15 362 CP 14 362 CP 15 4 NP 18 4 NP 20 362 NP 18 362 NP 20 250 NP 16 250 NP 18 250 SP 16 250 SP 18 250 SP 20	1149.3 1045.5 1003.4 913.3 266.2 165.6 229.9 143.2 262.9 139.0 527.6 270.8 194.1	383.1 348.5 334.5 304.4 88.7 55.2 76.6 47.7 87.6 46.3 175.9 90.3 64.7	287.3 261.4 250.9 228.3 66.6 41.4 57.5 35.8 65.7 34.8 131.9 67.7 48.5	191.6 174.3 167.2 152.2 44.4 27.6 38.3 23.9 43.8 23.2 87.9 45.1 32.4	127.7 116.2 111.5 101.5 29.6 18.4 25.5 15.9 29.2 15.4 58.6 30.1 21.6	95.8 87.1 83.6 76.1 22.2 13.8 19.2 11.9 21.9 11.6 44.0 22.6 16.2	76.6 69.7 66.9 60.9 17.7 11.0 15.3 9.5 17.5 9.3 35.2 18.1 12.9	279.1 253.8 220.8 201.0 88.7 55.2 76.6 47.7 46.7 38.0 80.1 61.6 45.8	209.3 190.4 165.6 150.7 66.6 41.4 57.5 35.8 35.0 28.5 60.0 46.2 34.4	139.5 126.9 110.4 100.5 44.4 27.6 38.3 23.9 23.3 19.0 40.0 30.8 22.9	93.0 84.6 73.6 67.0 29.6 18.4 25.5 15.9 15.6 12.7 26.7 20.5 15.3	69.8 63.5 55.2 50.2 22.2 13.8 19.2 11.7 9.5 20.0 15.4 11.5	55.8 50.8 44.2 40.2 17.7 11.0 15.3 9.5 9.3 7.6 16.0 12.3 9.2	199.1 161.4 201.6 163.7	99.5 80.7 100.8 81.9	199.1 161.4 201.6 163.7	99.5 80.7 100.8 81.9	
5	362 CP 14 362 CP 15 4 NP 18 4 NP 20 362 NP 18 362 NP 20 250 NP 16 250 NP 18 250 NP 20 250 SP 18 250 SP 20	1204.1 1096.0 319.5 198.7 275.9 171.8 315.5 166.8 104.3 325,0 233.0	481.7 438.4 127.8 79.5 110.4 68.7 126.2 66.7 41.7 130.0 93.2	361.2 328.8 95.8 59.6 82.8 51.5 94.6 50.0 31.3 97.5 69.9	240.8 219.2 63.9 39.7 55.2 34.4 63.1 33.4 20.9 65.0 46.6	160.6 146.1 42.6 26.5 36.8 22.9 42.1 22.2 13.9 43.3 31.1	120.4 109.6 31.9 19.9 27.6 17.2 31.5 16.7 10.4 32.5 23.3	96.3 87.7 25.6 15.9 22.1 13.7 25.2 13.3 8.3 26.0 18.6	381.5 347.3 127.8 79.5 110.4 68.7 80.7 65.7 41.7 106.5 79.2	286.1 260.5 95.8 59.6 82.8 51.5 60.5 49.3 31.3 79.9 59.4	190.8 173.6 63.9 39.7 55.2 34.4 40.3 32.8 20.9 53.2 39.6	127.2 115.8 42.6 26.5 36.8 22.9 26.9 21.9 13.9 35.5 26.4	95.4 86.8 31.9 19.9 27.6 17.2 20.2 16.4 10.4 26.6 19.8	76.3 69.5 25.6 15.9 22.1 13.7 16.1 13.1 8.3 21.3 15.8	241.9 196.5	120.9 98.2	241.9 196.5	120.9 98.2	
4	250 CP 16 250 CP 18 250 CP 20 4 NP 18 4 NP 20 362 NP 18 362 NP 20 250 NP 16 250 NP 18 250 NP 20 250 SP 18 250 SP 20	760.3 413.4 292.6 399.3 219.7 344.9 214.7 394.3 208.5 130.3 406.2 291.2	380.1 206.7 146.3 199.7 109.9 172.4 107.4 197.2 104.3 65.2 203.1 145.6	285.1 155.0 109.7 149.7 82.4 129.3 80.5 147.9 78.2 48.9 152.3 109.2	190.1 103.3 73.1 99.8 54.9 86.2 53.7 98.6 52.1 32.6 101.5 72.8	126.7 68.9 48.8 66.6 36.6 57.5 35.8 65.7 34.8 21.7 67.7 48.5	95.0 51.7 36.6 49.9 27.5 43.1 26.8 49.3 26.1 16.3 50.8 36.4	76.0 41.3 29.3 39.9 22.0 34.5 21.5 39.4 20.9 13.0 40.6 29.1	259.6 206.7 146.3 199.7 109.9 172.4 107.4 157.6 104.3 65.2 203.1 145.6	194.7 155.0 109.7 149.7 82.4 129.3 80.5 118.2 78.2 48.9 152.3 109.2	129.8 103.3 73.1 99.8 54.9 86.2 53.7 78.8 52.1 32.6 101.5 72.8	86.5 68.9 48.8 66.6 57.5 35.8 52.5 34.8 21.7 67.7 48.5	64.9 51.7 36.6 49.9 27.5 43.1 26.8 39.4 26.1 16.3 50.8 36.4	51.9 41.3 29.3 39.9 22.0 34.5 21.5 31.5 20.9 13.0 40.6 29.1					

1	ABLE 3	ALLOW	ABLE A	AXIAL L	OAD (L	BS.) FO	R STUD	S INTE	RIOD "	IO WINI	D11
	Coction	0	9'	10'	11'	12'	14'	16'	18'		
ī	UNCHED J	OISTS						10	10	20′	22′
0	10 JP 14 10 JP 15 9 JP 14 9 JP 16 8 JP 14 8 JP 16 6 JP 16 6 JP 18	19,172 17,349 18,830 13,309 18,382 13,000 12,027 6,404	19,069 17,257 18,699 13,219 18,211 12,882 11,797 6,325	18,954 17,155 18,553 13,118 18,019 12,749 11,541 6,238	18,827 17,041 18,391 13,007 17,807 12,602 11,257 6,141	18,688 16,916 18,213 12,884 17,575 12,441 10,946 6,035	18,373 16,635 17,812 12,608 17,050 12,077 10,243 5,796	18,010 16,310 17,348 12,289 16,444 11,658 9,432 5,519	17,599 15,942 16,824 11,928 15,758 11,182 8,513 5,206	17,139 15,531 16,237 11,524 14,991 10,651 7,486 4,856	16,631 15,076 15,589 11,078 14,143 10,064 6,352 4,469
i	JNPUNCHE	D NAILA	BLE STUI	OS							
	4 S 15 4 S 16 4 S 18 362 S 15 362 S 16 362 S 18 250 S 16 250 S 18 250 S 20	16,496 12,893 7,128 14,900 11,839 6,704 6,554 3,833 3,160	15,493 12,100 6,858 13,748 10,875 6,375 5,208 2,973 2,804	14,371 11,213 6,557 12,460 9,798 6,008 4,219 2,261 2,406	13,132 10,234 6,224 11,037 8,607 5,602 3,486 1,698 1,998	11,775 9,160 5,860 9,480 7,326 5,158 2,930 1,283 1,678	8,883 6,893 5,036 6,965 5,382 4,153 2,152 732 1,233	6,801 5,278 4,085 5,333 4,121 3,187	5,374 4,170 3,227 4,214 3,256 2,518	4,353 3,378 2,614 3,413 2,637 2,039	3,597 2,791 2,161
1	PUNCHED	NAILABL	E STUDS								
	4 SP 15 4 SP 16 4 SP 18 362 SP 15 362 SP 16 362 SP 18 250 SP 16 250 SP 18 250 SP 20	10,693 8,442 4,589 9,318 7,282 3,831 4,987 3,043 2,201	10,200 8,035 4,450 8,802 6,861 3,721 4,196 2,776 2,017	9,650 7,580 4,295 8,225 6,389 3,598 3,409 2,478 1,812	9,042 7,077 4,124 7,588 5,868 3,463 2,817 2,148 1,586	8,376 6,527 3,936 6,890 5,298 3,314 2,367 1,812 1,345	6,870 5,281 3,511 5,329 4,045 2,979 1,739 1,331 988	5,308 4,058 3,020 4,080 3,097 2,592	4,194 3,206 2,468 3,224 2,447 2,153	3,397 2,597 1,999 2,611 1,982 1,744	2,808 2,146 1,652
	PUNCHED	#158 CEE	STUDS					1 000	0.022	8,660	8,261
	8 CP 14 8 CP 15 8 CP 16 8 CP 18 6 CP 15 6 CP 16 6 CP 18 4 CP 14 4 CP 15 4 CP 16 4 CP 18 4 CP 20 362 CP 14 362 CP 15 362 CP 16 362 CP 18 362 CP 20 250 CP 18	10,257 9,297 7,960 4,236 8,411 7,232 3,891 8,729 7,921 7,091 3,973 2,802 7,161 6,414 3,642 2,700 4,977 3,131	10,177 9,227 7,902 4,216 8,282 7,126 3,855 8,372 7,598 6,804 3,873 2,738 7,493 6,806 6,098 3,531 2,621 4,295 2,893	10,086 9,148 7,839 4,194 8,137 7,007 3,814 7,238 6,482 3,761 2,666 7,053 6,409 5,744 3,407 2,533 3,548 2,627	9,986 9,062 7,768 4,170 7,977 6,876 3,769 7,532 6,840 6,127 3,638 2,587 6,567 5,969 5,352 3,270 2,435 2,932 2,333 1,785	9,877 8,967 7,690 4,143 7,802 6,733 3,720 7,049 6,403 5,739 3,502 2,500 6,035 5,489 4,924 3,120 2,328 2,464 2,012 1,543	9,630 8,753 7,515 4,083 7,407 6,408 3,608 5,957 5,417 4,860 3,196 2,303 4,832 4,401 3,955 2,781 2,086 1,810 1,478	9,345 8,505 7,313 4,014 6,951 6,034 3,479 4,719 4,296 3,859 2,842 2,077 3,703 3,374 3,033 2,390 1,386 1,132 868	9,022 8,225 7,084 3,935 6,433 5,610 3,334 3,728 3,395 3,049 2,442 1,820 2,926 2,666 2,396 1,950 1,491	7,912 6,828 3,847 5,855 5,135 3,171 3,020 2,750 2,470 2,008 1,533 2,370 2,159 1,941 1,579 1,208	7,566 6,546 3,750 5,216 4,611 2,991 2,496 2,272 2,041 1,660 1,267 1,959 1,785 1,604 1,305 998
	PLINCHED	2,385	2,206	2,006 STUDS	1,/85	2,010			1	3,943	3,634
	6 WP 15 6 WP 16 6 WP 18 6 WP 20 4 WP 16 4 WP 18 4 WP 20 362 WP 16 362 WP 18 362 WP 18 362 WP 18 362 WP 18	5,180 4,063 2,106 1,198 3,782 2,014 1,248 3,391 1,818 1,129 2,891	5,117 4,020 2,092 1,192 3,684 1,982 1,232 3,286 1,784 1,112 2,673	5,048 3,972 2,077 1,185 3,575 1,946 1,214 3,169 1,746 1,094 2,430 1,492	4,970 3,920 2,060 1,178 3,453 1,906 1,195 3,040 1,704 1,073 2,161 1,405	4,886 3,862 2,014 1,170 3,321 1,863 1,173 2,898 1,657 1,050 1,866 1,309 875	4,694 3,732 1,999 1,153 3,020 1,765 1,125 2,578 1,553 998 1,371 1,092 768	4,473 3,582 1,951 1,132 2,674 1,652 1,069 2,209 1,432 939 1,050 853 645	4,223 3,412 1,896 1,109 2,281 1,524 1,006 1,795 1,296 872	3,222 1,834 1,083 1,866 1,380 936 1,454 1,143 796	3,011 1,766 1,055 1,542 1,222 857 1,202 974 713
	250 WP 20	1,643 1,039	1,572 1,005	966	922	873			7 2248	3,002	2,731
0	6 NP 16 6 NP 18 6 NP 20 4 NP 16 4 NP 18 4 NP 20 362 NP 16 362 NP 18 362 NP 20 250 NP 18	4,088 2,139 1,217 3,891 2,118 1,276 3,400 1,870 1,180 2,672 1,607	4,033 2,121 1,210 3,748 2,071 1,254 3,250 1,821 1,155 2,363	3,972 2,101 1,201 3,587 2,018 1,230 3,083 1,765 1,127 2,017 1,391	3,904 2,079 1,192 3,409 1,959 1,203 2,898 1,704 1,097 1,672	3,830 2,054 1,182 3,215 1,894 1,173 2,696 1,637 1,063 1,405 1,126 800	3,662 1,999 1,159 2,775 1,748 1,106 2,239 1,485 986 1,032 841 643	3,468 1,936 1,132 2,268 1,580 1,029 1,743 1,310 898	3,248 1,864 1,102 1,793 1,390 942 1,377 1,111 798	1,784 1,069 1,452 1,177 844 1,116 906 687	1,696 1,031 1,200 973 736 922 749 571
-	Note: Refer to	1,007 1,042 Design Notes— le (1%"), N - N	1,505 990 -Page 31 larrow Flange (	1,391 933 1"), <b>C</b> - Cee Stud	& Joist, P-Put	nched, T - Track	B-Bridging, J	- Joist, S - Doub	le Stud, EWF	Extra Wide Fla	nge (21/2")

## TABLE 4 MAXIMUM ALLOWABLE LOADS (LBS.) FOR STUDS 15# WIND LOADING

7349 3309 3309 6334 2027 6404 HED 16496 2893 7128 4900 11839 6496 6496 6496 6496 92857 1655 NA 4900 1839 938 942 953 953 953 953 953 953 953 953 953 953	24" ISTS 17349 13309 13001 16334 12027 6404	17257 13219 12882 16047 11798 6325 15493 12100 6455 13748 10476 5446 3918 2044 1086	17257 13219 12882 16047 11798 6325 E ST 15493 11416 5454 12826 9327 4434 3238 1331 464	17155 13118 12749 15727 11541 6238	13104 9436 4396 10425	17041 13007 12602 15373 11257 6141	17 24" 17041 13007 12602 15373 11257 5849	16916 12884 12441 14986 10946 6035	16916 12884 12441 14986 10946 6035	16916 12884 12441 14986 10946 5257	16635 12608 12078 14110 10243 5613	16635 12608 12078 14110 10243 5047	16635 12608 12078 14023 9055 4032	16310 12289 11658 13099 8995 4623	16" 16310 12289 11658 12829 8256 3980	16310 12289 11658 11358 7000 2866	15942 11928 11183 11284 7195 3667	18' 16" 15942 11928 11183 10405 6464 2994	15942 11840 10012 8922 5235 1849	15531 11525 10651 9119 5647 2815
7349 3309 3001 6334 2027 6404 HED 16496 62893 7128 4900 11839 6496 6496 5369 2857 1655 NA 44589 9318 7283 3831 7283 3831 7283 3831 7283 2103	17349 13309 13001 16334 12027 6404 NAI 16496 12893 6544 14900 11475 5572 4606 2104 1000 NILAE	17257 13219 12882 16047 11798 6325 LABL 15493 12100 6455 13748 10476 5446 3918 2044 1086	17257 13219 12882 16047 11798 6325 <b>E ST</b> 15493 11416 5454 12826 9327 4434 3238 1331 464	17155 13118 12749 15727 11541 6238 TUDS 14372 10662 5476 11689 8542 4441	17155 13118 12749 15727 11541 6238 13104 9436 4396 10425	17041 13007 12602 15373 11257 6141	17041 13007 12602 15373 11257 5849	16916 12884 12441 14986 10946 6035	16916 12884 12441 14986 10946	16916 12884 12441 14986 10946	16635 12608 12078 14110 10243	16635 12608 12078 14110 10243	16635 12608 12078 14023 9055	16310 12289 11658 13099 8995	16310 12289 11658 12829 8256	16310 12289 11658 11358 7000	15942 11928 11183 11284 7195	15942 11928 11183 10405 6464	15942 11840 10012 8922 5235	15531 11525 10651 9119 5647
7349 3309 3309 6334 2027 6404 HED 16496 2893 7128 4900 11839 6496 6496 6496 6496 92857 1655 NA 4900 1839 938 942 953 953 953 953 953 953 953 953 953 953	17349 13309 13001 16334 12027 6404 NAI 16496 12893 6544 14900 11475 5572 4606 2104 1000 NILAE	17257 13219 12882 16047 11798 6325 LABL 15493 12100 6455 13748 10476 5446 3918 2044 1086	13219 12882 16047 11798 6325 <b>E ST</b> 15493 11416 5454 12826 9327 4434 3238 1331 464	13118 12749 15727 11541 6238 TUDS 14372 10662 5476 11689 8542 4441	13118 12749 15727 11541 6238 13104 9436 4396 10425	13007 12602 15373 11257 6141 12182 8865	13007 12602 15373 11257 5849	12884 12441 14986 10946 6035	12884 12441 14986 10946	12884 12441 14986 10946	12608 12078 14110 10243	12608 12078 14110 10243	12608 12078 14023 9055	12289 11658 13099 8995	12289 11658 12829 8256	12289 11658 11358 7000	11928 11183 11284 7195	11928 11183 10405 6464	11840 10012 8922 5235	1152 1065 911 564
3309 3001 46496 62893 7128 6496 62893 7128 6496 6496 6496 6496 6496 6496 6496 7183 8442 9459 9318 8442 9459 9318 8442 9459 9318 9318 9318 9318 9318 9318 9318 931	13309 13001 16334 12027 6404 16496 12893 6544 14900 11475 5572 4606 2104 1000 11475 10693 8442 4294 9318 7283	13219 12882 16047 11798 6325 LABL 15493 12100 6455 13748 10476 5446 3918 2044 1086	13219 12882 16047 11798 6325 <b>E ST</b> 15493 11416 5454 12826 9327 4434 3238 1331 464	13118 12749 15727 11541 6238 TUDS 14372 10662 5476 11689 8542 4441	13118 12749 15727 11541 6238 13104 9436 4396 10425	13007 12602 15373 11257 6141 12182 8865	13007 12602 15373 11257 5849	12884 12441 14986 10946 6035	12884 12441 14986 10946	12884 12441 14986 10946	12608 12078 14110 10243	12608 12078 14110 10243	12608 12078 14023 9055	12289 11658 13099 8995	12289 11658 12829 8256	12289 11658 11358 7000	11928 11183 11284 7195	11928 11183 10405 6464	11840 10012 8922 5235	1152 1065 911 564
06496 12893 7128 4900 11839 6496 5369 2857 1655 NA 0693 8442 4589 9318 7283 3831 4190 2103	16496 12893 6544 14900 11475 5572 4606 2104 1000 11693 8442 4294 9318 7283	15493 12100 6455 13748 10476 5446 3918 2044 1086	15493 11416 5454 12826 9327 4434 3238 1331 464	14372 10662 5476 11689 8542 4441	13104 9436 4396 10425	8865				-			-	1020			1			1
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## TABLE 5 MAXIMUM ALLOWABLE LOADS (LBS.) FOR STUDS 20# WIND LOADING

	-	8		9	U SPA	10	,	11	,		12'			14'			1.50				וטח	
		-	24"	16"	-	-	24"	16"	24"	12"	16"	24"	12"	16"	24"	12"	16"	044		18'		20'
	PUNCHE	Acres 1													2.4	12	16"	24"	12"	16"	24"	12"
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-	PUNCHE	-	58 C		TUD								T	Locas	Tocan	0245	9345	8769	9022	8682	7394	8252
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	UNCH		1	CHAI	-	STU						Lagra	3854	334	5 2450	2997	1 177	7   91	7 223	1   11	10 77	
	6 NP 15 6 NP 16 6 NP 18 6 NP 16 4 NP 16	5051 4081 2130 1001 362	505 408 1 181	497 8 403 8 193 1 83 5 304	5 4975 3 3941 8 1525 3 473 2 2347	4891 3972 1702 648 2470	4593 3513 1210 224 1737 116	3698 1457 454 1944	3059 885 1201	3704 1534 541	331 119 25 7 148	56	2985 1081 219 1162 110	251 67 75	1 6	64	19 24	7	25 25 6			
-	A NP 200 IA	52 291 113 139	231 231	7 24 7 235 7 78	9 9 1712 6 211	1839 466	1176	1383	724	137/ 30/ 32	1 .		755								ange (2	14.51

#### TABLE 6 MAXIMUM ALLOWABLE LOADS (LBS.) FOR STUDS 25# WIND LOADING STUD LENGTH AND SPACING 14' 16' 18' 9' 10' 11' 12' 20' 12" 24" 12" 16" 24" 12" 16" 24" 24" 12" 16" 16" 16" 24" 16" 24" 16" 24' 24" 12" **PUNCHED JOISTS** 13219 10 JP 15 9 JP 16 8 JP 16 6 JP 14 6 JP 16 6 JP 18 UNPUNCHED NAILABLE STUDS 4 S 15 4 S 16 4 S 18 362 S 15 362 S 16 362 S 18 250 S 16 250 S 18 **PUNCHED NAILABLE STUDS** 4 SP 15 4 SP 16 2510 2758 4 SP 18 3547 362 SP 15 362 SP 16 740 362 SP 18 250 SP 16 250 SP 18 **PUNCHED #158 CEE STUDS** 8 CP 14 8 CP 15 8 CP 16 8 CP 18 6 CP 15 6 CP 16 2906 6 CP 18 6 CP 20 4 CP 14 4 CP 15 4 CP 16 4 CP 18 4 CP 20 3846 362 CP 14 362 CP 15 5417 2225 362 CP 16 1312 362 CP 18 362 CP 20 250 CP 16 250 CP 18 **PUNCHED #138 CHANNEL** STUDS 6 WP 16 6 WP 18 6 WP 20 WP 16 4 WP 18 362 WP 16 362 WP 18 250 WP 16 **PUNCHED #100 CHANNEL** STUDS 6 NP 18 6 NP 20 4 NP 16 362 NP 16 362 NP 18

NOTE: BRIDGING RECOMMENDATIONS: Walls up to 10 feet high — One row of bridging. From 10 to 14 feet high — Two rows of bridging.

Walls above 14 feet high — One row of bridging for every 4 feet of wall height.

## TABLE 7 MAXIMUM ALLOWABLE LOADS (LBS.) FOR STUDS 30# WIND LOADING

	8'						The little			401			2-1						_		-
			9	24"	16"		11		10"	12'			14′			16′			18'		20'
	16"	24"	16"	24"	16"	24"	16"	24"	12"	16"	24"	12"	16"	24"	12"	16"	24"	12"	16"	24"	12"
PUNCHE 10 JP 15	17349	17349		17257	17155	17155	17041	17041	16916	16916	16916	16635	16635	16635	16310	16310	16310	15942	15942	14591	15531
9 JP 16 8 JP 16 6 JP 14 6 JP 16 6 JP 18	13001 16334	13001 16334	12882 16047	12882 16047	12749 15727	13118 12749 15727 11252 4723	13007 12602 15373 11257 5168	13007 12602 15373 9988 3906	12884 12441 14986 10946 5257	12884 12441 14986 10311 4486	12884 12441 13902 8695 3089	12608 12078 14023 9055 4032	12608 12078 12849 8016 3130	12402 10811 10794 6226 1555	12289 11658 11358 7000 2866	12289 10639 10094 5930 1903	10597 8746 7944 4122 258	11840	10724 8818 7667 4197 875	8706 6731 5554 2454	10329 8341 6853 3798 1012
UNPUNC	HED	NAII	LABL	E ST	UDS						0000	1002	0100	1000	2000	1303	250	1043	0/3		1012
4 S 15 4 S 16 4 S 18 362 S 15 362 S 16 362 S 18 250 S 16 250 S 18 250 S 20	16496 12543 5753 14401 10519 4751 3963 1467 446	15292 10887 4334 12601 8876 3316 2884 397	14458 10389 4568 11736 8350 3559 2665 730	12490 8631 3026 9890 6702 2064 1703	11927 8394 3463 9358 6480 2515 1773 192	9936 6635 1869 7565 4894 1018 908	9668 6653 2487 7339 4926 1639 1147	7734 4953 890 5645 3437 176 360	8823 6143 2587 6589 4475 1765 1126	7727 5182 1654 5653 3657 925 696	5889 3569 85 4083 2283	5691 3798 1265 4100 2640 662 487	4739 2964 392 3298 1938	3142 1564 1952 761	3684 2318 362 2572 1525	2851 1588 1870 911	1454 363 692	2379 1365 1584 813	1639 617 960 267	397	1496 728 920 341
PUNCHE	D NA	ILAE	BLE S	TUD	S																
4 SP 15 4 SP 16 4 SP 18 362 SP 15 362 SP 16 362 SP 18 250 SP 16 250 SP 18	10693 8442 3783 9318 6786 2831 3085 1071	10260 7361 2851 8269 5747 1936 2236 272	9916 7162 3049 7927 5566 2180 2132 537	8602 5961 2010 6693 4465 1190 1352	8401 5912 2342 6516 4445 1564 1417 133	7008 4668 1243 5258 3341 522 714	6973 4776 1698 5253 3471 1011 912	5570 3539 575 4021 2398 273	6513 4501 1797 4870 3260 1158 899	5697 3786 1133 4167 2651 531 549	4325 2587 2986 1629	4388 2883 888 3102 1951 398 384	3643 2238 248 2482 1418	2394 1155 1443 524	2846 1754 242 1937 1117	2191 1188 1395 651	1093 240 486	1831 1025 1184 585	1249 522 703 171	273	1144 538 679 233
PUNCHE	D #1	58 C	EE S	TUD:	S																
8 CP 14 8 CP 15 8 CP 16 8 CP 18 6 CP 16 6 CP 16 6 CP 19 4 CP 14 4 CP 15 4 CP 16 4 CP 18 4 CP 18 4 CP 18 362 CP 14 362 CP 15 362 CP 16 362 CP 18 362 CP 20 250 CP 18	10257 9297 7960 4236 8411 7232 3891 2651 8729 7921 7009 3229 1919 7754 6848 5920 2663 1584 3061 1169	10257 9297 7960 4236 8411 7232 3610 2195 8062 7058 6033 2379 1184 6707 5835 4947 1813 825 2180 329	10177 9227 7902 4216 8282 7126 3776 2361 7900 6947 5976 2601 1427 6526 5712 4882 2039 1080 2128 608	10177 9227 7902 4216 8282 7126 3141 1799 6710 5800 4876 1638 604 5377 4609 3830 1106 259	10086 9148 7839 4194 8137 7007 3394 2044 6680 5823 4952 1984 956 5345 4652 3908 1453 622 1408 174	10086 9148 7839 3884 7916 6582 2634 1377 5409 4605 3792 951 79 4164 3503 2835 477 661	9987 9062 7768 4158 7977 6823 2983 1708 5524 4769 4003 1412 527 4283 3669 3047 932 224 899	9987 9062 7768 3491 7072 5827 2106 946 4231 3533 2830 342 3115 2555 1990	9877 8967 7690 4143 7802 6733 3088 1825 5243 4551 3849 1539 688 4038 3485 2923 1067 394 887 27	9877 8967 7690 3849 7396 6167 2554 1362 4485 3163 902 150 3365 2843 2314 484 516	9877 8967 7558 3069 6195 5047 1573 518 3208 2609 2008	9630 8753 7515 3697 6643 5546 2327 1228 3510 2992 2468 714 91 2545 2147 1744 360 358	9630 8753 7457 3165 5853 4812 1688 684 2803 2318 1829 85 1942 1571 1198	8840 7743 6333 2162 4472 3528 557 1618 1187 758 929 604 281	9345 8505 7123 3077 5235 4322 1585 663 2226 1847 1465 110 1523 1237 950	8769 7733 6380 2425 4388 3535 855 72 1597 1247 896	7278 6278 5024 1229 2944 2191 542 239	8344 7383 6114 2425 3970 3227 920 168 1357 1076 794 866 656 445	1675 3121	5711 4819 3733 333 1691 1102	7071 6212 5092 1779 2907 2309 358 774 561 349 428 270 113
	1			1	_	3918	4264	3271	4331	3723	2620	3355	2641	1390	2419	1652	341	1596	818		914
6 WP 15 6 WP 16 6 WP 18 6 WP 20 4 WP 16 4 WP 18 362 WP 16 362 WP 18 250 WP 16	5180 4063 1727 626 2988 866 2392 562 990	1215 170 2153 120 1574	1427 375 2375 436 1800 155 474	3204 801 1436 907	3467 1104 110 1780 28 1250 76	2658 369 777 320	3022 767 1233	199	3126 930 1363 902	2561 427 749 349	1533	2310 360 585 250	1647	482	23	820		857	126		296
PUNCHE	ED #1	00 0	CHAN	INEL		1	1	0104	4000	2517	2401	2100	2450	1220	2005	1507	070	1460	777		-
6 NP 15 6 NP 16 6 NP 18 6 NP 20 4 NP 16 4 NP 18 362 NP 16		3804 381 381 381 287 2185 391 1544	394 5 152 7 473 5 234 5 51	3292 5 937 7 1458 2 898	2   3513 7   1210 224 8   1737 116	2747 525 819	3059 885 1201	3124 2192 115 282	4092 3124 1027 118 1283 820	3517 2595 561 746 353	2491 1647	3109 2300 481 565 248	2456 1698 61	1330 656	2205 1546 79	1527 917	379	911	773 284		832 402

NOTE: BRIDGING RECOMMENDATIONS: Walls up to 10 feet high — One row of bridging. From 10 to 14 feet high — Two rows of bridging. Walls above 14 feet high — One row of bridging for every 4 feet of wall height.

Note: Refer to Design Notes —Page 31

## TABLE 8 MAXIMUM ALLOWABLE LOADS (LBS.) FOR STUDS 40# WIND LOADING

	8	_		)'	ACING	0'	1	1'		12'			14'			16'			18'		
	16"	24"	16"	24"	16"	24"	16"	24"	12"	16"	24"	12"	16"	24"	12"	16"	24"	12"	16"	24"	20
PUNCHE				24	10	2-7	10												10	24"	12
10 JP 15 9 JP 16 8 JP 16 6 JP 14 6 JP 16 6 JP 18	17349 13309 13001 16334 12027 6404	17349 13309 13001 16334 12027 5519	17257 13219 12882 16047 11798 5811	17257 13219 12882 16047 11449 4631	17155 13118 12749 15727 11541 5081	17155 13118 12749 15646 10082 3696	17041 13007 12602 15373 10456 4313	17041 13007 12602 14009 8665 2753	16916 12884 12441 14986 10311 4486	16916 12884 12441 14466 9210 3536	16916 12884 11593 12315 7260 1836	16635 12608 12078 12849 8016 3130	16635 12608 11325 11444 6789 2053	16635 11091 9345 9007 4688 186	16310 12289 10639 10094 5930 1903	16310 11157 9351 8617 4687 774	14979 9003 7055 6112 2591	15942 10724 8818 7667 4197 875	15245 9352 7391 6213 2998	12724 6901 4917 3769 984	906 7 707 9 565
UNPUNC	HED	NAI	LABI	LE ST	TUDS																_
4 S 15 4 S 16 4 S 18 362 S 15 362 S 16 362 S 18 250 S 16 250 S 18	15869 11412 4786 13168 9392 3769 3220 731	13692 9437 3075 11045 7467 2068 1974	13108 9182 3513 10467 7216 2533 2003 36	10798 7126 1689 8323 5306 786 892	10558 7185 2369 8124 5389 1486 1177	8248 5146 507 6051 3557 178	8337 5483 1389 6173 3901 633 605	6101 3518 4216 2182	7727 5182 1654 5653 3657 925 696	6462 4071 575 4572 2711 200	4340 2208 2759 1125	4739 2964 392 3298 1938	3640 2000 2371 1128	1796 384 817	2851 1588 1870 911	1889 745 1059 202	276	1639 716 960 267	784 239		83 14 35
PUNCHE	D N	AILA		STUE	S																_
4 SP 15 4 SP 16 4 SP 18 362 SP 15 362 SP 16 362 SP 18 250 SP 16 250 SP 18	10630 7708 3150 8629 6077 2223 2500 522	9219 6393 2011 7267 4838 1132 1519	9019 6340 2340 7081 4811 1504 1595	7450 4918 1098 5630 3522 324 694	7445 5058 1589 5652 3685 850 933	5813 3606 295 4191 2405	6008 3925 927 4406 2733 282 472	4379 2493 2981 1493	5697 3786 1133 4167 2651 531 549	4753 2961 362 3354 1947	3166 1574 1991 767	3643 2238 248 2482 1418	2783 1492 1767 803	1341 242 567	2191 1188 1395 651	1436 535 769 113	167	1249 522 703 171	577 146		245
PUNCHE	D #1	58 C	EE S	TUD	S																
8 CP 14 8 CP 15 8 CP 16 8 CP 18 6 CP 16 6 CP 18 6 CP 20 4 CP 14 4 CP 15 4 CP 16 4 CP 18 4 CP 20 362 CP 16 362 CP 16 362 CP 18 362 CP 18 362 CP 20 250 CP 16	10257 9297 7960 4236 8411 7232 3779 2345 8396 6346 2653 1420 7041 6158 5256 2085 1067 2454 591	10257 9297 7960 4210 8411 7232 3113 1753 7120 6144 5153 1605 518 5776 4938 4087 1054 151 1436	10177 9227 7902 4216 8282 7126 3350 1983 7088 6164 5225 1945 866 5739 4956 4161 1401 518 1562	10177 9227 7902 3797 7984 6613 2532 1262 5663 4793 3914 785 4383 3657 2924 292	10086 9148 7839 4069 8137 6861 2882 1595 5809 4988 4156 1277 356 4534 3856 3171 784 38	10086 9148 7839 3340 7060 5779 1918 753 4314 3557 2796 52 3158 2542 1923	9987 9062 7768 3711 7417 6149 2390 1192 4636 3920 3197 678 3479 2903 2320 252	9987 8965 7409 2845 6090 4909 1294 245 3131 2483 1834 2127 1612 1097	9877 8967 7690 3849 7396 6167 2554 1362 4485 3828 3163 902 150 3365 2843 2314 484	9877 8967 7690 3325 6581 5407 1888 788 3606 2989 2369 159 2588 2102 1612	9387 8226 6735 2320 5113 4039 683 2128 1579 1032	9630 8753 7457 3165 5853 4812 1688 684 2803 2318 1829 85 1942 1571 1198	9238 8133 6698 2488 4908 3934 916 28 1988 1540 1092 1245 906 567	7695 6622 5284 1225 3270 2411 619 234	8769 7733 6380 2425 4388 3535 885 72 1597 1247 896	7757 6746 5460 1614 3396 2612 56 870 553 238	5929 4962 3799 142 1712 1046	7394 6458 5255 1675 3121 2436 195 798 542 288	6246 5340 4216 760 2138 1518	4231 3378 2394 482	603 520 415 95 208 154 27 8
PUNCHE		38 C	HANI	NEL :	STUD	)S															
6 WP 15 6 WP 16 6 WP 18 6 WP 20 4 WP 16 4 WP 18 362 WP 16	5180 3894 1384 320 2421 360 1835	4549 3180 721 1395 846	4775 3427 1006 1735 1189	3849 2554 206 606 130	4199 2921 608 1094 612	3110 1900	3592 2394 202 523 118	2360 1244	3723 2561 427 749 349	2974 1862 33	1628 608	2641 1647	1786 851	301	1652 820	752		818 126			149
250 WP 16 PUNCHE	441 D #10	00 C	HANI	NEL :	STUE	S															
6 NP 15 6 NP 16 6 NP 18 6 NP 20 4 NP 16 4 NP 18 362 NP 16 250 NP 16	5051 3977 1494 426 2447 452 1790 383	4430 3297 870 1458 868	4619 3504 1129 130 1738 1154	3731 2678 382 687 200	4034 2995 747 1107 612	3002 2039 35	3426 2470 363 569 168	2276 1407	3517 2595 561 746 353	2818 1949 124	1581 807	2456 1698	1684 984	360	1527 917	738 182		773 284			187

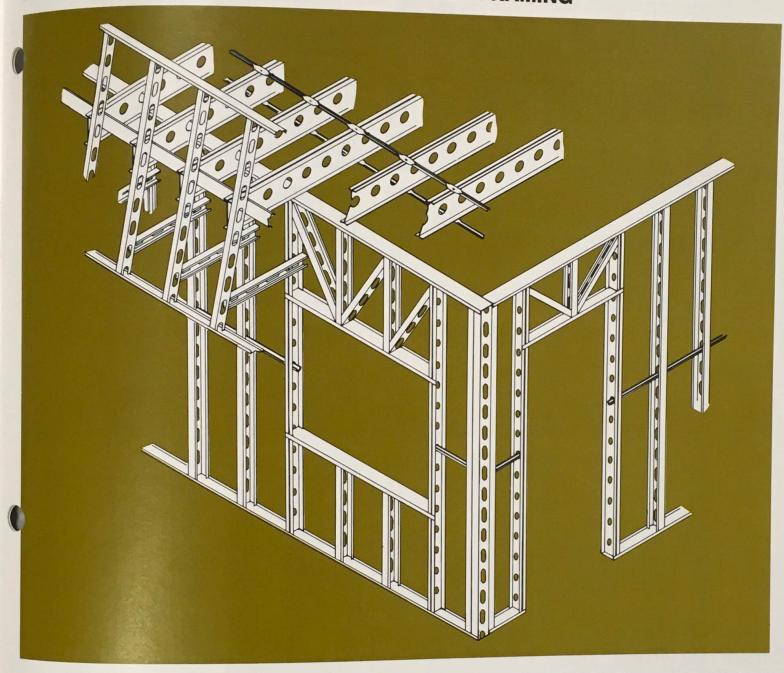
NOTE: BRIDGING RECOMMENDATIONS: Walls up to 10 feet high — One row of bridging. From 10 to 14 feet high — Two rows of bridging.

Walls above 14 feet high — One row of bridging for every 4 feet of wall height.

Note: Refer to Design Notes -Page 31

W-Wide Flange (1%"), N-Narrow Flange (1"), C-Cee Stud & Joist, P-Punched, T-Track, B-Bridging, J-Joist, S-Double Stud, EWF-Extra Wide Flange (2½")

## TYPICAL ASSEMBLY OF STRUCTURAL STEEL FRAMING



#### Specifications

#### 1. MATERIALS:

All structural stud framing members, track, bridging, and non-load bearing studs shall be of the type and size shown on the drawings and specifications and shall be manufactured by Wheeling Corrugating Co., Division of Wheeling-Pittsburgh Steel Corporation, Wheeling, W. Va.

All Wheeling 16 gage and heavier painted structural members shall be formed from steel that meets the requirements of ASTM A570-66T, Grade D, except that the steel shall be minimum 50 ksi yield. All Wheeling 16 gage and heavier galvanized structural members shall be formed from steel that meets the requirements of ASTM A446-71, Grade D, except that the steel shall be minimum 50 ksi yield.

All Wheeling 18 gage and lighter painted structural members shall be formed from steel that meets the requirements of ASTM A611-70, Grade C, modified to a minimum yield point of 37 ksi. All Wheeling 18 gage and lighter galvanized structural members shall be formed from steel that neets the requirements of ASTM A446-71, Grade B, with minimum yield point of 37 ksi. Bridging does not conform to the above specifications.

All Wheeling structural framing components shall be given a coat of rust resisting paint or be galvanized, field abrasions and welds shall be touched up in the field after erection.

All structural properties shall be computed in accordance with A.I.S.I. "Specification for the Design of Cold Formed Steel Structural Members" 1968 edition. Base uncoated steel thickness shall be manufacturers standard gage in all cases and weights listed are based thereon.

#### 2. FABRICATION:

Wheeling structural framing components may be prefabricated into panels prior to erection.

All framing components shall be cut squarely or at an angle to fit squarely against abutting members. Members shall be held firmly in position until properly fastened. Prefabricated panels shall be square and braced against racking. Attachments of similar components shall be done by welding. Dissimilar structural components shall be attached by welding, screw attachment, or bolting. Wire Tying of Framing Components in Structural Applications shall not be permitted.

#### 3. ERECTION:

Track shall be securely anchored to the floor and overhead structure or member. Studs shall be seated squarely in the track with the stud web and flange abutting the track web, plumbed or aligned, and securely attached to the flanges or web of both the upper and lower tracks.

Splices in axial loaded studs shall not be permitted. All welds shall be fillet, plug, butt or seam.

## TABLE 9 STUDS USED AS CURTAIN WALL MAXIMUM ALLOWARIE CLEAR SPAN HEIGHTS IN FEET

MAXIMU	M AI	LLOW	ABLE	CLE	AR S	PAN	HEIG	HIS	IIA I	CEI				
WIND LOAD		15 LI	BS.			20 L	.BS.				25	LBS.		
DEFLECTION	L/24		L/36	0	L/2	40	L/3			L/240	24"	12"	L/360 16"	0.411
SPACING	16"	24"	16"	24"	16"	24"	16"	24"	12"	16"	24	12	16"	24"
PUNCHED	JOISTS					40.0	40.3	35.2	47.1	42.8	37.4	41.1	37.4	32.7
12 JP 12 10 JP 15 9 JP 16 8 JP 16 6 JP 14	50.7 37.1 31.5 28.6 25.4	44.3 32.4 27.5 25.0 22.2	44.3 32.4 27.5 25.0 22.2	38.7 28.3 24.1 21.8 19.4	46.1 33.7 28.6 26.0 23.1	40.3 29.4 25.0 22.7 20.1	29.4 25.0 22.7 20.1	25.7 21.9 19.8 17.6	34.4 29.3 26.5 23.6	31.3 26.6 24.1 21.4	27.3 23.2 21.1 18.7	30.1 25.6 23.2 20.6	27.3 23.2 21.1 18.7	23.9 20.3 18.4 16.3
6 JP 16 6 JP 18	22.5	19.6	19.6 18.2	17.2 15.9	20.4	17.8 16.5	17.8 16.5	15.6 14.4	20.9 19.3	19.0 17.5	16.6 15.3	18.2 16.9	16.6 15.3	14.5 13.4
UNPUNCH		ILABLE	STUDS		10.0	10.0								
4 \$ 15 4 \$ 16 4 \$ 18 362 \$ 15 362 \$ 16 362 \$ 18 250 \$ 16 250 \$ 18 250 \$ 20	17.6 16.1 14.8 16.2 14.9 13.6 10.9 10.0 9.1	15.3 14.1 12.9 14.1 13.0 11.9 9.6 8.8 7.9	15.3 14.1 12.9 14.1 13.0 11.9 9.6 8.8 7.9	13.4 12.3 11.3 12.4 11.3 10.4 8.4 7.7 6.9	15.9 14.7 13.5 14.7 13.5 12.4 9.9 9.1 8.3	13.9 12.8 11.8 12.8 11.8 10.8 8.7 8.0 7.2	13.9 12.8 11.8 12.8 11.8 10.8 8.7 8.0 7.2	12.2 11.2 10.3 11.2 10.3 9.5 7.6 7.0 6.3	16.3 15.0 13.8 15.0 13.8 12.7 10.2 9.3 8.4	14.8 13.6 12.5 13.7 12.5 11.5 9.2 8.5 7.7	12.9 11.9 10.9 11.9 10.9 10.0 8.1 7.4 6.7	14.2 13.1 12.0 13.1 12.0 11.1 8.9 8.1 7.4	12.9 11.9 10.9 11.9 10.9 10.0 8.1 7.4 6.7	11.3 10.4 9.5 10.4 9.6 8.8 7.0 6.5 5.9
PUNCHED	NAILA		UDS											
4 SP 15 4 SP 16 4 SP 18 362 SP 15 362 SP 16 362 SP 18 250 SP 16 250 SP 18 250 SP 20	17.5 16.0 14.7 16.1 14.8 14.1 10.9 10.0 9.1	15.3 14.0 12.9 14.1 12.9 12.3 9.5 8.7 7.9	15.3 14.0 12.9 14.1 12.9 12.3 9.5 8.7 7.9	13.3 12.2 11.2 12.3 11.3 10.8 8.3 7.6 6.9	15.9 14.6 13.4 14.6 13.4 12.8 9.9 9.1 8.2	13.9 12.7 11.7 12.8 11.7 11.2 8.7 7.9 7.2	13.9 12.7 11.7 12.8 11.7 11.2 8.7 7.9 7.2	12.1 11.1 10.2 11.2 10.2 9.8 7.6 6.9 6.3	16.2 14.9 13.7 14.9 13.7 13.1 10.1 9.3 8.4	14.7 13.5 12.4 13.6 12.4 11.9 9.2 8.4 7.6	12.9 11.8 10.9 11.9 10.9 10.4 8.0 7.4 6.7	14.2 13.0 11.9 13.1 12.0 11.4 8.8 8.1 7.3	12.9 11.8 10.9 11.9 10.9 10.4 8.0 7.4 6.7	11.2 10.3 9.5 10.4 9.5 9.1 7.0 6.4 5.8
PUNCHED	#158	CEE ST	UDS											
6 CP 15 6 CP 16 6 CP 18 6 CP 20 4 CP 14 4 CP 15 4 CP 16 4 CP 18 4 CP 20 362 CP 14 362 CP 15 362 CP 16 362 CP 20 250 CP 16 250 CP 18 250 CP 20	22.0 21.2 19.7 18.0 16.5 16.1 15.5 14.4 13.2 15.3 14.8 14.3 12.2 10.8 10.1 9.2	19.2 18.5 17.2 15.7 14.4 14.0 13.5 12.6 11.5 13.4 12.9 12.5 11.7 10.7 9.4 8.8 8.0	19.2 18.5 17.2 15.7 14.4 14.0 13.5 12.6 11.5 13.4 12.9 12.5 11.7 10.7 9.4 8.8 8.0	16.8 16.2 15.1 13.7 12.6 12.1 11.8 11.0 10.1 11.7 11.3 10.9 10.2 9.3 8.2 7.7 7.0	20.0 19.2 17.9 16.4 15.0 14.6 14.0 13.1 12.0 13.9 13.5 13.0 12.1 11.1 9.8 9.1 8.4	17.4 16.8 15.7 14.3 13.1 12.7 12.3 11.4 10.5 12.1 11.8 11.3 10.6 9.7 8.5 8.0 7.3	17.4 16.8 15.7 14.3 13.1 12.7 12.3 11.4 10.5 12.1 11.8 11.3 10.6 9.7 8.5 8.0 7.3	15.2 14.7 13.7 12.5 11.5 11.1 10.7 10.0 9.1 10.6 10.3 9.9 9.3 8.5 7.5 7.0 6.4	20.4 19.7 18.3 16.7 15.3 15.0 14.3 13.4 12.2 14.2 13.8 13.3 12.4 11.3 10.0 9.3 8.5	18.5 17.9 16.6 15.2 13.9 13.7 13.0 12.2 11.1 12.9 12.5 12.1 11.3 10.3 9.1 8.5 7.8	16.2 15.6 14.5 13.3 12.2 11.9 11.4 10.6 9.7 11.3 10.9 10.5 9.8 9.0 7.9 7.4 6.8	17.8 17.2 16.0 14.6 13.4 13.1 12.5 11.7 10.7 12.4 12.0 11.6 10.8 9.9 8.7 8.2 7.5	16.2 15.6 14.5 13.3 12.2 11.9 11.4 10.6 9.7 11.3 10.9 10.5 9.8 9.0 7.9 7.4 6.8	14.1 13.6 12.7 11.6 10.6 10.4 9.9 9.3 8.5 9.5 9.2 8.6 7.8 6.9 6.5 5.9
PUNCHED		CHANN			10.5	100	1 100							
6 WP 15 6 WP 16 6 WP 18 6 WP 20 4 WP 16 4 WP 18 4 WP 20 362 WP 16 362 WP 18 362 WP 20 250 WP 16 250 WP 20	20.4 19.6 18.3 14.7 14.3 13.3 11.2 13.2 12.3 10.4 9.9 9.3 8.2	17.8 17.2 15.3 12.0 12.5 11.6 9.1 11.5 10.7 8.5 8.7 8.1 6.7	17.8 17.2 16.0 14.6 12.5 11.6 10.6 11.5 10.7 9.8 8.7 8.1 7.4	15.6 15.0 14.0 12.0 10.9 10.1 9.1 10.1 9.4 8.5 7.6 7.1 6.5	18.5 17.9 16.3 12.7 13.0 12.1 9.7 12.0 11.2 9.0 9.0 8.4 7.1	16.2 15.6 13.3 10.4 11.3 10.1 7.9 10.5 9.4 7.4 7.9 7.3 5.8	16.2 15.6 14.5 12.7 11.3 10.5 9.6 10.5 9.7 8.9 7.9 7.3 6.7	14.1 13.6 12.7 10.4 9.9 9.2 7.9 9.1 8.5 7.4 6.9 6.4 5.8	18.9 18.2 16.8 13.2 13.2 12.3 10.0 12.2 11.4 9.3 9.2 8.6 7.4	17.2 16.6 14.6 11.4 12.0 11.0 8.7 11.1 10.3 8.1 8.4 7.8 6.4	15.0 14.5 11.9 9.3 10.5 9.0 7.1 9.7 8.4 6.6 7.3 6.6 5.2	16.5 15.9 14.8 13.2 11.6 10.8 9.8 10.7 10.0 9.1 8.0 7.5 6.9	15.0 14.5 13.5 11.4 10.5 9.8 8.7 9.7 9.0 8.1 7.3 6.8 6.2	13.1 12.6 11.8 9.3 9.2 8.6 7.1 8.5 7.9 6.6 6.4 6.0 5.2
PUNCHE	Contract of the last	CHANN	-		1	1					O.L	0.0	VIE	
6 NP 15 6 NP 16 6 NP 18 6 NP 20 4 NP 16 4 NP 18 4 NP 20 362 NP 16 362 NP 18 362 NP 18 250 NP 18	19.2 18.5 17.2 15.4 13.3 12.4 11.3 12.2 11.4 10.4 9.1 8.5 7.8	16.7 16.1 15.0 12.6 11.6 10.8 9.4 10.7 9.9 8.7 8.0 7.4 6.8	16.7 16.1 15.0 13.7 11.6 10.8 9.9 10.7 9.9 9.1 8.0 7.4 6.8	14.6 14.1 13.1 12.0 10.1 9.4 8.6 9.3 8.7 7.9 7.0 6.5 5.9	17.4 16.8 15.6 13.3 12.0 11.2 10.0 11.1 10.3 9.3 8.3 7.7 7.1	15.2 14.7 13.6 10.9 10.5 9.8 8.1 9.7 9.0 7.6 7.2 6.8 5.9	15.2 14.7 13.6 12.4 10.5 9.8 9.0 9.7 9.0 8.3 7.2 6.8 6.2	13.3 12.8 11.9 10.9 9.2 8.6 7.8 8.5 7.9 7.2 6.3 5.9 5.4	17.1 16.0 13.8 12.3 11.5 10.3 11.3 10.6 9.6 8.5 7.9 7.2	15.6 14.5 11.9 11.2 10.4 8.9 10.3 9.6 8.3 7.7 7.2 6.5	13.6 12.4 9.7 9.8 9.1 7.3 9.0 8.4 6.8 6.7 6.3 5.3	15.0 13.9 12.7 10.8 10.0 9.1 9.9 9.2 8.4 7.4 6.9 6.3	13.6 12.7 11.6 9.8 9.1 8.3 9.0 8.4 7.7 6.7 6.3 5.7	11.9 11.1 9.7 8.5 8.0 7.3 7.9 7.3 6.7 5.9 5.5 5.0

NOTES: 1. All heights are computed in accordance with A.I.S.I. "Specification for the Design of Cold-Formed Steel Structural Members," latest edition.

2. To convert wind velocity into a wind load in pounds per square foot use the following formula: Wind pressure (PSF) = 0.00256V<sup>2</sup>

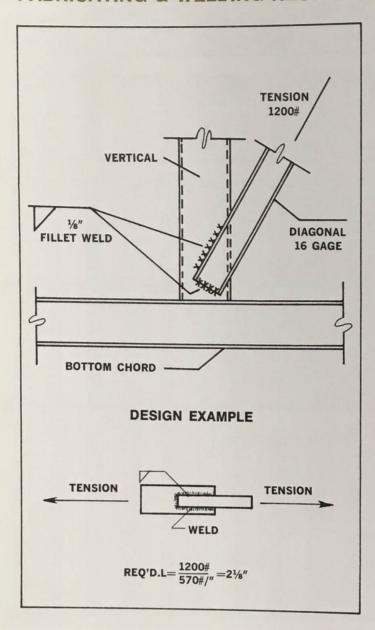
Local codes should be followed for design wind loads or velocities.

3. No composite action is considered between the study and the collateral wall material.

## TABLE 9 STUDS USED AS CURTAIN WALL MAXIMUM ALLOWABLE CLEAR SPAN HEIGHTS IN FEET

LOAD -			30 LB	S					40 1	DO								
FATION	L	/240	30 LD		/360			L/240	40 L	.BS.	1 /250					LBS.		
ECTION			24" 1	12"	16"	24"	12"	16"	24"	12"	L/360 16"	24"	10"	L/24	_	-	L/36	
CHED	JOIST	S									10	24"	12"	16"	24"	12"	16"	24"
2 JP 12 0 JP 15 9 JP 16 8 JP 16 6 JP 14 6 JP 16 6 JP 18	44.3	40.3 29.4 25.0 22.7 20.1 17.8	25.7 21.9 19.8 17.6 15.6	38.7 28.3 24.1 21.8 19.4 17.2 15.9	35.2 25.7 21.9 19.8 17.6 15.6 14.4	30.7 22.5 19.1 17.3 15.4 13.6 12.6	40.3 29.4 25.0 22.7 20.1 17.8	36.6 26.7 22.7 20.6 18.3 16.2	32.0 23.4 19.9 18.0 16.0 14.2	35.2 25.7 21.9 19.8 17.6 15.6	32.0 23.4 19.9 18.0 16.0 14.2	27.9 20.4 17.3 15.7 14.0 12.4	37.4 27.3 23.2 21.1 18.7 16.6	34.0 24.8 21.1 19.1 17.0 15.0	29.7 21.7 18.4 16.7 14.8 13.1	32.7 23.9 20.3 18.4 16.3 14.5	29.7 21.7 18.4 16.7 14.8 13.1	25.9 18.9 16.1 14.6 13.0 11.5
		AILAB		UDS	14.4	12.0	16.5	15.0	13.1	14.4	13.1	11.4	15.3	13.9	12.2	13.4	12.2	10.6
4 \$ 15 4 \$ 16 4 \$ 18 362 \$ 15 362 \$ 16 362 \$ 18 250 \$ 16 250 \$ 18 250 \$ 20	15.3 14.1 12.9 14.1 13.0 11.9 9.6 8.8 7.9	13.9 12.8 11.8 12.8 11.8 10.8 8.7 8.0 7.2	12.2 11.2 10.3 11.2 10.3	13.4 12.3 11.3 12.4 11.3 10.4 8.4 7.7 6.9	12.2 11.2 10.3 11.2 10.3 9.5 7.6 7.0 6.3	10.6 9.8 9.0 9.8 9.0 8.3 6.6 6.1 5.5	13.9 12.8 11.8 12.8 11.8 10.8 8.7 8.0 7.2	12.7 11.6 10.7 11.7 10.7 9.8 7.9 7.2 6.6	11.1 10.2 9.3 10.2 9.4 8.6 6.9 6.3 5.7	12.2 11.2 10.3 11.2 10.3 9.5 7.6 7.0 6.3	11.1 10.2 9.3 10.2 9.4 8.6 6.9 6.3 5.7	9.7 8.9 8.2 8.9 8.2 7.5 6.0 5.5 5.0	12.9 11.9 10.9 11.9 10.0 8.1 7.4 6.7	11.8 10.8 9.9 10.8 9.9 9.1 7.3 6.7 6.1	10.3 9.4 8.7 9.5 8.7 8.0 6.4 5.9 5.3	11.3 10.4 9.5 10.4 9.6 8.8 7.0 6.5 5.9	10.3 9.4 8.7 9.5 8.7 8.0 6.4 5.9 5.3	9.0 8.2 7.6 8.3 7.6 7.0 5.6 5.1
NCHED	NAIL	ABLE	STUD	S														
4 SP 15 4 SP 16 4 SP 18 62 SP 15 62 SP 16 62 SP 18 50 SP 16 50 SP 18 50 SP 20	15.3 14.0 12.9 14.1 12.9 12.3 9.5 8.7 7.9	13.9 12.7 11.7 12.8 11.7 11.2 8.7 7.9 7.2	12.1 11.1 10.2 11.2 10.2 9.8 7.6 6.9 6.3	13.3 12.2 11.2 12.3 11.3 10.8 8.3 7.6 6.9	12.1 11.1 10.2 11.2 10.2 9.8 7.6 6.9 6.3	10.6 9.7 8.9 9.7 8.9 8.5 6.6 6.1 5.5	13.9 12.7 11.7 12.8 11.7 11.2 8.7 7.9 7.2	12.6 11.6 10.6 11.6 10.2 7.9 7.2 6.5	11.0 10.1 9.3 10.1 9.3 8.9 6.9 6.3 5.7	12.1 11.1 10.2 11.2 10.2 9.8 7.6 6.9 6.3	11.0 10.1 9.3 10.1 9.3 8.9 6.9 6.3 5.7	9.6 8.8 8.1 8.9 8.1 7.8 6.0 5.5 5.0	12.9 11.8 10.9 11.9 10.9 10.4 8.0 7.4 6.7	11.7 10.7 9.9 10.8 9.9 9.4 7.3 6.7 6.1	10.2 9.4 8.6 9.4 8.6 8.2 6.4 5.8 5.3	11.2 10.3 9.5 10.4 9.5 9.1 7.0 6.4 5.8	10.2 9.4 8.6 9.4 8.6 8.2 6.4 5.8	8.9 8.2 7.5 8.2 7.5 7.2 5.6 5.1 4.6
NCHED																		
6 CP 15 6 CP 16 6 CP 18 6 CP 20 4 CP 14 4 CP 15 4 CP 16 4 CP 20 862 CP 14 862 CP 15 862 CP 16 862 CP 18 862 CP 20 250 CP 16 250 CP 18	19.2 18.5 17.2 15.7 14.4 14.0 13.5 12.6 11.5 13.4 12.9 12.5 11.7 10.7 9.4 8.8 8.0	17.4 16.8 15.7 14.3 13.1 12.7 12.3 11.4 10.5 12.1 11.8 11.3 10.6 9.7 8.5 8.0 7.3	15.2 14.7 13.7 12.5 11.5 11.1 10.7 10.0 9.1 10.6 10.3 9.9 9.3 8.5 7.5 7.0 6.4	16.8 16.2 15.1 13.7 12.6 12.2 11.8 11.0 10.1 11.7 11.3 10.9 10.2 9.3 8.2 7.7 7.0	15.2 14.7 13.7 12.5 11.5 11.1 10.7 10.0 9.1 10.6 10.3 9.3 8.5 7.5 7.0 6.4	13.3 12.8 12.0 10.9 10.0 9.7 9.4 8.7 8.0 9.3 9.0 8.7 8.1 7.4 6.5 6.1 5.6	17.4 16.8 15.7 14.3 13.1 12.7 12.3 11.4 10.5 12.1 11.8 11.3 10.6 9.7 8.5 8.0 7.3	15.8 15.3 14.2 13.0 11.9 11.6 11.1 10.4 9.5 11.0 10.7 10.3 9.6 8.8 7.8 7.2 6.6	13.8 13.3 12.4 11.3 10.4 10.1 9.7 9.1 8.3 9.6 9.3 9.0 8.4 7.7 6.8 6.3 5.8	15.2 14.7 13.7 12.5 11.5 11.1 10.7 10.0 9.1 10.6 10.3 9.9 9.3 8.5 7.5 7.0 6.4	13.8 13.3 12.4 11.3 10.4 10.1 9.7 9.1 8.3 9.6 9.3 9.0 8.4 7.7 6.8 6.3 5.8	12.1 11.7 10.9 9.9 9.1 8.8 8.5 7.9 7.2 8.4 8.2 7.9 7.3 6.7 5.9 5.5 5.1	16.2 15.6 14.5 13.3 12.2 11.8 11.4 10.6 9.7 11.3 10.9 10.5 9.8 9.0 7.9 7.4 6.8	14.7 14.2 13.2 12.1 11.1 10.7 10.3 9.7 8.8 10.2 9.9 9.6 8.9 8.2 7.2 6.7 6.2	12.8 12.4 11.5 10.3 9.7 9.4 9.0 8.4 7.7 8.9 8.7 8.4 7.8 7.1 6.3 5.9 5.4	14.1 13.6 12.7 11.6 10.6 10.3 9.9 9.3 8.5 9.8 9.5 9.2 8.6 7.8 6.9 6.5 5.9	12.8 12.4 11.5 10.5 9.7 9.4 9.0 8.4 7.7 8.9 8.7 8.4 7.8 7.1 6.3 5.9 5.4	11.2 10.8 10.1 9.2 8.4 8.2 7.9 7.4 6.7 7.8 7.6 7.3 6.8 6.2 5.5 5.1 4.7
			_		_	12.4	16.2	147	129	141	129	11.2	15.0	13.7	11.9	13.1	11.9	10.4
6 WP 15 6 WP 18 6 WP 20 4 WP 16 4 WP 20 362 WP 16 362 WP 18 362 WP 20 250 WP 16	17.2 15.3 12.0 12.5 11.6 9.1 11.5 10.7 8.5 8.7 8.7	15.6 13.3 10.4 11.3 10.1 7.9 10.5 9.4 7.4 7.9 7.3 5.8	13.6 10.8 8.5 9.9 8.2 6.5 9.1 7.7 6.0 6.9 6.0 4.8	15.0 14.0 12.0 10.9 10.1 9.1 10.1 9.4 8.5 7.6 7.1 6.5	13.6 12.7 10.4 9.9 9.2 7.9 9.1 8.5 7.4 6.9 6.4 5.8	11.9 10.8 8.5 8.6 8.0 6.5 8.0 7.4 6.0 6.0 5.6	15.6 13.3 10.4 11.3 10.1 7.9 10.5 9.4 7.4 7.9 7.3 5.8	14.2 11.5 9.0 10.3 8.7 6.8 9.5 8.1 6.4 7.2 6.4 5.0	12.4 9.4 7.4 9.0 7.1 5.6 8.3 6.6 5.2 6.2 5.2 4.1	13.6 12.7 10.4 9.9 9.2 7.9 9.1 8.5 7.4 6.9 6.4 5.8	12.4 11.5 9.0 9.0 8.4 6.8 8.3 7.7 6.4 6.2 5.8 5.0	10.8 9.4 7.4 7.8 7.1 5.6 7.3 6.6 5.2 5.5 5.1 4.1	14.5 11.9 9.3 10.5 9.0 7.1 9.7 8.4 6.6 7.3 6.6 5.2	13.2 10.3 8.1 9.5 7.8 6.1 8.8 7.3 5.7 6.6 5.7 4.5	11.5 8.4 6.6 8.3 6.4 5.0 7.7 5.9 4.7 5.8 4.7 3.7	12.6 11.8 9.3 9.2 8.6 7.1 8.5 7.9 6.6 6.4 6.0 5.2	11.5 10.3 8.1 8.3 7.8 6.1 7.7 7.2 5.7 5.8 5.4 4.5	10.0 8.4 6.6 7.3 6.4 5.0 6.7 5.9 4.7 5.1 4.7 3.7
-				L STU		11.6		13.9	121		12.1	10.5	1/1	12.0	11.2	12.2	11.0	0.0
6 NP 15 6 NP 16 6 NP 18 6 NP 20 4 NP 16	5 6 6 16.1 8 15.0 12.6 6 11.6 8	14.7 13.6 10.9 10.5 9.8 4 8.1	12.8 11.3 8.9 9.2 8.4 6.6	14.1 13.1 12.0 10.1 9.4 8.6 9.3	12.8 11.9 10.9 9.2 8.6 7.8	11.6 11.2 10.4 8.9 8.0 7.5 6.6 7.4	14.7 13.6 10.9 10.5 9.8 8.1 9.7	13.8 13.3 12.0 9.4 9.6 8.9 7.0 8.8 8.2	12.1 11.6 9.8 7.7 8.4 7.3 5.8 7.7	12.8 11.9 10.9 9.2 8.6 7.8 8.5	11.6 10.8 9.4 8.4 7.8 7.0	10.2 9.5 7.7 7.3 6.8 5.8	14.1 13.6 12.4 9.7 9.8 9.1 7.3 9.0	12.8 12.4 10.7 8.4 8.9 8.0 6.3 8.2	11.2 10.8 8.7 6.9 7.8 6.5 5.1 7.1	12.3 11.9 11.1 9.7 8.5 8.0 7.3 7.9	11.2 10.8 10.1 8.4 7.8 7.2 6.3	9.8 9.4 8.7 6.9 6.8 6.3 5.1 6.2
N 866 866 866 866 866 866 866 866 866 866	CHEL  6 CP 15  6 CP 16  6 CP 16  6 CP 18  6 CP 20  4 CP 14  4 CP 15  4 CP 16  4 CP 18  4 CP 20  2 CP 14  2 CP 16  0 CP 16  0 CP 18  0 CP 20  CP 16  0 WP 15  6 WP 15  6 WP 16  6 WP 18  4 WP 18  4 WP 20  2 WP 18  5 WP 20  6 WP 20  NCHE  6 NP 11  6 NP 11  6 NP 11  6 NP 11  4 NP 1  4 NP 1	CHED #158  G CP 15	CHED #158 CEE  GCP 15	CHED #158 CEE STUD  GCP 15	CHED #158 CEE STUDS  GCP 15	CHED #158 CEE STUDS  GCP 15	CHED #158 CEE STUDS  5 CP 15	CHED #158 CEE STUDS  GCP 15	CHED #158 CEE STUDS  GCP 15	CHED #158 CEE STUDS  GOP 15	CHED #158 CEE STUDS    19.2	CHED #158 CEE STUDS  5 CP 15	CHED #158 CEE STUDS  5 CP 15	CHED #158 CEE STUDS  3 CP 15	CHED #158 CEE STUDS  5 CP 15	CHED #158 CEE STUDS  3CP 15	CHED #158 CEE STUDS    Cop   15	CHED #158 CEE STUDS

### **FABRICATING & WELDING RECOMMENDATIONS**



GAGE	THICKNESS	THROAT AREA 0.707 x t x 1"	WELD IN SHEAR (LBS. PER LINEAL INCH)
18	0.048	0.0339	460
16	0.060	0.0424	570
15	0.070	0.0495	670
14	0.075	0.053	720
12	0.100	0.0707	960

#### CUTTING

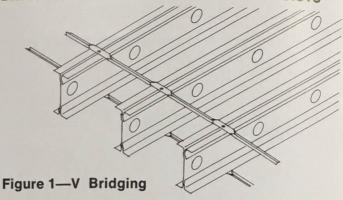
The material may be cut by an oxyacetylene torch or, preferably, by a radial-arm saw, such as manufactured by Dewalt, Inc. The saw should be fitted with a ½" thick, high-speed (15,000 to 18,000 rpm rim speed) circular blade, with 300 teeth and six expansion slots.

#### FASTENING

Sections may be fastened together with bolts or sheet-metal screws or may be welded. Fusion welding is generally used. For welding, a direct-current welder of 200 or more ampere capacity is recommended. A heat of 60 to 90 amperes (depending on the gage of metal).

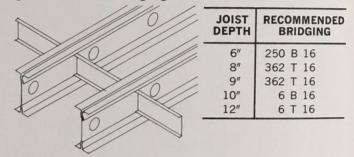
An ASTM electrode classification A233E60 is recommended.

#### BRIDGING RECOMMENDATIONS FOR JOISTS

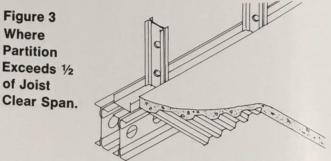


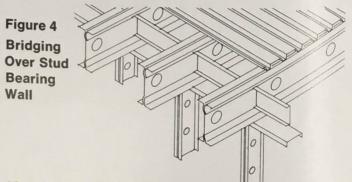
V bridging shall be in place prior to placing of any construction loads. All runs shall be rigidly anchored to end walls and solid bridging be used as shown in Fig.

Figure 2—Solid Bridging



Solid bridging is recommended for the first and last 3 joists and under concentrated loads, in addition to bridging.





### JOIST BRIDGING REQUIREMENTS:

SPAN	ROWS OF BRIDGING
UP TO 14' 14' TO 20' 20' TO 26' 26' TO 32' OVER 32'	ONE ROW NEAR CENTER 2 ROWS PLACED AT 1/3 POINTS OF SPAN 3 ROWS AT 1/4 POINTS OF SPAN 4 ROWS AT 1/5 POINTS OF SPAN AT 8' CENTERS

## FIRE RATING INFORMATION

Wheeling Steel Framing is an incombustible building material which will not contribute to the flame spread. An extensive fire test program shows that the following table can be assumed correct:

#### Fire Rated Load Bearing Steel Stud Partitions:

#### 1 hour

 $\frac{3}{4}$ " sanded gypsum plaster on metal lath each side of steel studs. (Either face exposed)

#### 2 hour

2 layers 5%" fire-rated gypsum wallboard each side of steel studs. (Either face exposed)

1'' stucco on metal lath,  $\frac{1}{2}''$  gypsum sheathing, steel studs,  $\frac{5}{8}''$  fire-rated gypsum wallboard. (Stucco face exposed)

#### 4 hour

 $3\frac{3}{4}$ " brick veneer, 1" insulating material, steel studs,  $\frac{3}{4}$ " gypsum plaster on metal lath. (Brick face exposed)

#### 4 hours

Floor and ceiling with steel joists:

 $2\frac{1}{2}$ " concrete floor on metal lath with 1" vermiculite plaster on metal lath ceiling.

#### 2 hours

Floor and ceiling with steel joists:

 $2 \% ^{\prime\prime}$  concrete floor on metal lath with  $\% ^{\prime\prime}$  sanded gypsum plaster on metal lath ceiling.

#### **DESIGN NOTES:**

- 1. All structural properties are computed in accordance with the A.I.S.I. "Specification for the Design of Coldformed Steel Structural Members," latest edition.
- Load computations are based on wall materials or sheathing being properly attached on both sides to furnish adequate lateral support to the studs about their minor axis.

- 3. For combined axial and wind load values, the allowable stresses are increased 33% (Sec. 3.1.2.2, A.I.S.I. Code).
- 4. Q values are to be used when computing axial loads.
- The maximum average shear stress, Fv, in kips per square inch, on the gross area of a flat web shall not exceed the following shear stress.

Where the web consists of two or more sheets, each sheet shall be considered as a separate member carrying its share of the shear.

(a) For h/t not greater than  $\frac{547}{\sqrt{\text{fy}}}$ 

 $\mathbf{F}\mathbf{v} = \underbrace{152 \sqrt{\mathbf{f}\mathbf{y}}}_{\mathbf{h}/t} \text{ with a maximum of}$ 

(b) For h/t greater than 547Fv = 83,200 $\frac{(h/t)^2}{}$ 

Where

t = web thickness, in.

h = clear distance between flanges measured along the plane of web, in.

fy = yield point, ksi.

6. Cee Stud and Joist Bridging Recommendations.

 2½"
 Studs
 ¾" C.R. Channel

 3¾"
 Studs
 250 NP 18 Stud

 4"
 Studs
 250 T 18 Track

 6"
 Studs
 4 T 18 Track

Note for studs over 6"—Use any channel which fits between lips of flange.

7. The sectional properties were determined on the basis of the AISI Specification for the design of cold-formed steel structural members, 1968 Edition.

a. Yield point of material

Fy = 50 ksi for 16 gage or heavier

Fy = 37 ksi for 18 gage or thinner Design Fy = 33 ksi

- b. The properties listed in this table apply only when the sections are adequately braced laterally.
- Allowable uniform load tables: Total load limited by stress. Live load limited by deflection, L/360.

## RECOMMENDED ATTACHMENT OF COLLATERAL MATERIALS

MATERIAL		NAILS	SELF-DRILLING SCREWS			
Aluminum		Stainless steel per manufacturer's specifications				
Wood	%" to ½" ½" to ¾" 15%"	8D Common 8D Common 10D Common	6-20x1¾" TEKS®/3 w/pilot 6-20x1¾" TEKS/3 w/pilot 12-24x2½" Phillips Flat Head, TEKS/4			
Plywood	%" to ½" ½" to ¾" 1½"	8D Cement Coated 8D Cement Coated 8D Cement Coated	6-20x1¾" TEKS/3 w/pilot 6-20x1¾" TEKS/3 w/pilot 10-24x2½" TEKS/3 w/pilot			
Metal Lath	1/6	%" x 13/4" Galv. Roofing	8x½" TEKS/3 Pancake Head			
Wood Fibers Sheeting or Decking	ed 1" 2" 3"	8D Cement Coated 10D Cement Coated 10D Cement Coated	12–14x1¾" TEKS/4 Bugle Head 12–14x2¾" TEKS/4 Bugle Head 12–14x3¾" TEKS/4 Bugle Head			
25/32" Insu		8D Cement Coated	6-20x1 <sup>1</sup> 1/ <sub>6</sub> " TEKS/3 w/pilot			
Gypsum Wallboard	½" or ¾" to 25 gauge ½" or ¾" up to 12 gauge	8D Cement Coated Cooler 8D Cement Coated Cooler	1" Type S Hi-LO® Bugle Head 6–20x1" S-12, Bugle Head			
Brick Ties	71 0176 up to 12 gamp	8D Common	10–16x%" TEKS/3 HWH			
Metal Deck	Covered Exposed	8D Cement Coated 8D Neoprene Washer	10–16x%" TEKS/3 HWH 12–14x¾" HWH, TEKS/3 w/sealing washe			
Stud to Tra	ck	(Do not use)	6-20x½" TEKS/3 Pan Head			
V Bridging		8D Galv. Common	12-24x¾" TEKS/3			

#### Other Wheeling Building Products

Expanded Metal Decorative Mesh 

Metal Lath and Accessories Expanded Metal Gratings and Partitions 

Bank Vault Reinforcing Steel Pipe ■ Roof Deck and Tensilform ■ Dry Wall Studs

#### Sales Offices and Warehouses

ATLANTA, GA. 30340 De Kalb Bldg.-North Park 2801 Clearview Place, N.E. (404) 458-0093 BOSTON, MASS. 01801 10 Wheeling Ave. (617) 935-5550 **BUFFALO, N.Y. 14225** 1722 Walden Ave. (716) 896-7444 CHICAGO (ITASCA), ILL. 60143 1550 Bryn Mawr Avenue (312) 773-0640 COLUMBUS, OHIO\* 43212 1100 Steelwood Rd. (614) 486-4318 DETROIT, MICH. 48126 6410 Miller Road (313) 584-2005 2749 U.S. Highway 50 (303) 243-1156

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9801 Alden Road (913) 888-4900 LOUISVILLE, KY. 40210 1424 S. 15th Street (502) 634-0541 340 27th Ave., N.E. (612) 789-7233

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**Wheeling Road** Jamesburg (609) 655-3553 N.Y. (212) 784-8580 Phila. (215) 329-1600

OAKLAND, CALIF. 94611

1880 Pleasant Valley Ave. (415) 653-8386

ORLANDO, FLA.\* 32804

2515 Shrader Rd. (305) 295-7272

RICHMOND, VA. 23224

1600 Jefferson Davis Hwy. (703) 232-8916

STATESVILLE, N.C.\* 28677 ST. LOUIS, MO. 63110 Industrial Drive (704) 872-2471

WHEELING, W. VA. 26003

722 S. Vandeventer Ave. (314) 531-3900 1134 Market Street (304) 234-2346

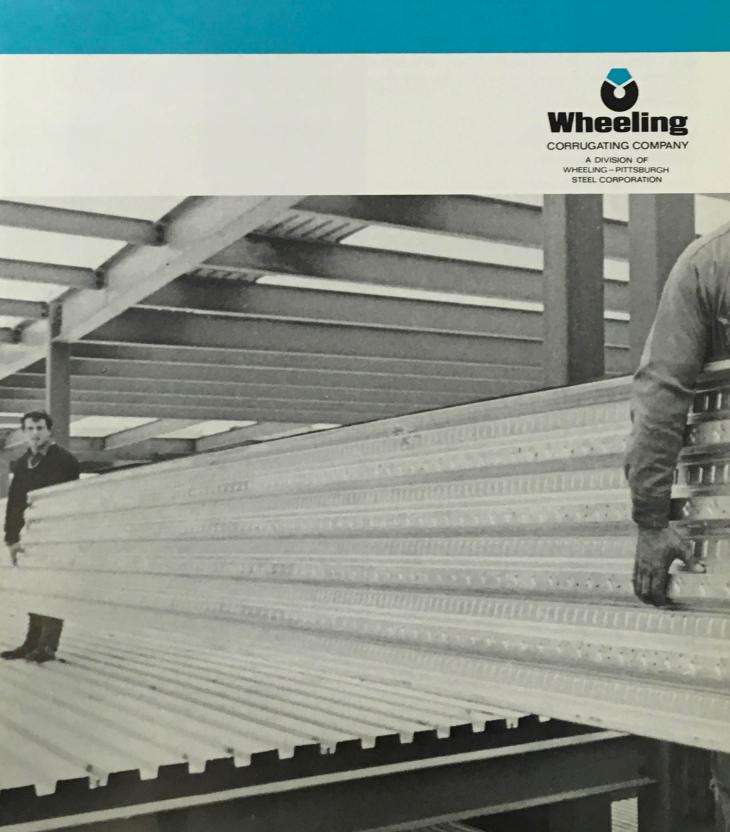
\*Warehouse only



A DIVISION OF WHEELING-PITTSBURGH STEEL CORPORATION WHEELING, WEST VIRGINIA 26003



# Wheeling\* roof decks composite floor decks permanent forms



### Whatever you need...

... in technical information to select and specify any of the standard lengths and gages of Wheeling steel roof deck and permanent steel forms is presented in this booklet. This information will help you select the products quickly and easily, and at the same time enable you to obtain the most economical load carrying capacities to meet your specifications. Information on non-standard sizes, or technical assistance can be obtained from your Wheeling Sales Representatives or any of the Wheeling Corrugating Company Sales Offices, by mail or phone.

#### Wheeling Super-Rib Steel Roof Decks

There are times when the selection of one component for a building will trigger the cost of other components up or down. The roof system of a structure is such a component.

Directly affected by the selection of a roof system is the durability of the structure, its heating plant design, insur-

ance premiums and maintenance cost.

Wheeling Super-Rib Steel Roof Deck holds these costs to a minimum. And its low initial cost helps reduce costs in other areas of construction. Installation is fast too. For example: it is easy to lay Super-Rib in place and fasten it permanently to purlins or joists by welding from the top of the roof deck. Consequently, the building will be "under roof" quickly to permit the internal phases of construction to begin without delay.

#### FINISHES

Wheeling Super-Rib Steel Roof Deck is furnished phosphatized with an attractive primer paint or galvanizedtwo finishes that will increase the value of the structure and reduce life-long maintenance. This makes Wheeling Super-Rib an excellent choice for your structure.

#### ADVANTAGES

· lightweight, high quality, structural grade steel

- · quickly installed, regardless of the weather or location
- · adds rigidity to the entire structure—particularly when applied as a diaphragm

· efficient packaging for fast job site handling

- · low costs for fire insurance and extended coverage
- · deck is protected with a grey polyester primer

· optimum widths in lengths up to 42 feet

· certified for your protection. Request certification.

Wheeling Corrugating Company reserves the right to change the design and/or specifications of its products without notice,

#### **Derivation of Data**

The technical data contained in this catalog is based on the provisions of the latest edition of Light Gage Cold Formed Steel Design Manual as published by the American Iron and Steel Institute; and also conforms to the specifications of the Steel Deck Institute.

The following criteria were used in the published loadings. Deflection characteristics for steel deck have been derived in accordance with the requirements of the Steel Deck Institute. Deflection of Tensilform is based on free uniform loaded theoretical data.

Design	Moment	Deflection Roof Deck	Deflection Tensilform
one span	$M = fS = \frac{wL^2}{8}x12$	D max = $\frac{5 \text{ w}_1 \text{L}^4}{384 \text{ EI}} \times 1728$	D max = $\frac{.01302 \text{ w}_1 \text{L}^4}{\text{EI}} \times 1728$
two spans	$M = fS = \frac{wL^2}{8}x12$	D max = $\frac{3 \text{ w}_1 \text{L}^4}{384 \text{ EI}} \times 1728$	D max = $\frac{.00542 \text{ w}_1 \text{L}^4}{\text{EI}} \times 1728$
three or more spans	$M = fS = \frac{wL^2}{10} \times 12$	D max = $\frac{3 \text{ w}_1 \text{L}^4}{384 \text{ EI}} \times 1728$	D max = $\frac{.00688 \text{ w}_1 \text{L}^4}{\text{EI}} \times 1728$

#### MAXIMUM DEFLECTION

L/240 for steel deck. The dead load allowance has been taken at 7.15 PSF plus the weight of the deck. This value is based upon a typical 20 year bonded built up roof specification with insulation and slag aggregate.

L/240 and L/180 for Tensilform. Tabulations are given

in superimposed load capacities.

#### DECK WEIGHTS

Note: All deck weight data shown in this catalog are approximate values to be used for design purposes only.

#### MAXIMUM STRESS AND DESIGN CRITERIA

The maximum allowable design stress recommended by the Steel Deck Institute is 20 KSI (20,000 pounds per square inch) for roof deck which conforms to ASTM specification A611 grade C for painted; or ASTM specification A446 grade A, with 1.25 oz. galvanized coating conforming to ASTM specification A525 for zinc coated deck, Deflection coefficients are those indicated in formulae.

Maximum allowable design stress for Tensilform is 30 KSI which conforms to ASTM specification A446 grade E with or without specified zinc coating conforming

to ASTM specification A525.

## DIAPHRAGM DESIGN

To add structural rigidity to a building, designers will frequently employ the steel deck as a diaphragm. Special welding is received the steel deck as a diaphragm. welding is required to provide essential shear resistance so that when properly fastened and connected, the steel deck may allow for elimination of a certain amount of cross, or wind-bracing.

Design shear values have been derived by an independent consulting engineer for Wheeling Corrugating Company from the results of an extensive series of tests conducted at West Viscoin of an extensive series of tests conducted at West Virginia University. The International Conference of Building Conversity. ence of Building Officials has approved Wheeling Steel Deck for Lateral Diaphragm.

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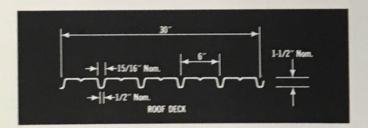
Roof Decks		722	Insulation	
Tool Decks	Туре	Rib Configuration	Contact Area %	Page No.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	A	Narrow	76	4
7~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	B & BW	Wide	58	5
(BM)r	B & BW Sound	Wide	58	6
~~~~~	E & ES	Intermediate	76	7
<b>^</b>	F	Intermediate	65	8
<b>√</b> ~~	Н			9 .
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WHEELING/SUPER-RIB ROOF DECK





#### SECTIONAL PROPERTIES, TYPE A

	Gage						
Properties	22	20	18				
Weight Painted, PSF	1.76	2.12	2.83				
Weight Galvanized, PSF	1.82	2.18	2.90				
Section Modulus, in.3	.123	.148	.197				
Moment of Inertia, in.4	.144	.173	.231				

(Approximate weights for design purposes)

#### SAFE UNIFORM TOTAL LOAD - PSF

AFE CITE														
Number of Spans	Gage	4'0"	4'6"	5′0″	5′6″	6'0"	6'6"	7'0"	7'6"	8'0"	8'6"	9'0"	9'6"	10'0'
1 Span	22 20 18	102 113 158	80 90 125	65 73 101	54 60 84	45 50 70	39 43 60	33 37 52	29 32 45	39	34			
2 Span	22 20 18	103 123 164	81 97 130	66 79 105	54 65 87	46 55 73	39 47 62	34 40 54	29 35 47	41	36	32		
3 Span	22 20 18	129 154 205	102 122 162	83 99 131	68 82 109	57 69 91	49 58 78	42 50 67	37 44 58	32 39 51	34 45	41	36	22

The amount of dead load included is 10 PSF, All loads are governed by the allowable flexural stress limit of 20 KSI. Live load deflection does not accred 1/240th of the span. Span length assumes center-to-center opacing of supports. Tabulated loads shall not be in-

cressed by assuming clear span dimensions

### Type A-Nestable Deck

Narrowed ribs assure maximum adhesive contact surface for insulation . . . permit the safe use of all types of insulating materials. When vapor barrier is required, narrow rib openings offer greater protection from damage. Specially designed cross section assures ample room inside of rib for fast topside welding. Now available in 30" widths and maximum 42' lengths.

All deck sheets 7 feet or longer are swaged 3" for smooth end lap unless otherwise noted. Sheets under 7 feet are not swaged except by special arrangements.

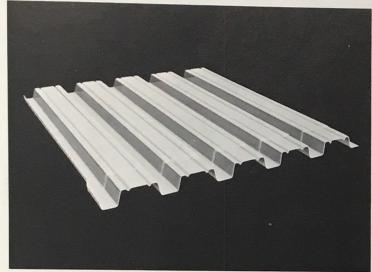
Note: Type A Deck is available without the rib stiffener from our Lenexa, Kansas plant.

It. or ress.
 The rib width limitation shown for narrow rib are taken at the theoretical intersection points

<sup>3.</sup> Normal installations covered by this table do not require midspan fasteners for spans of

# pe B/BW

WHEELING/SUPER-RIB ROOF DECK

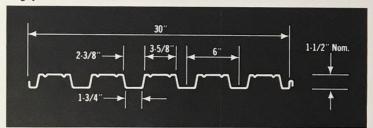


These deck shapes, designed to achieve optimum structural efficiency, are available in 30-inch widths, up to 42-foot lengths, and four gages. Both decks are wide rib designs that offer economy because of their greater load capacities per pound of steel. The type B Deck with its standing seam side lap construction can be button punched to adjoining sheets for fast installation. Both decks are recommended for purlin spacings up to 10 feet and can, in certain instances, be used up to 12 feet. Type BW is a nestable roof deck.

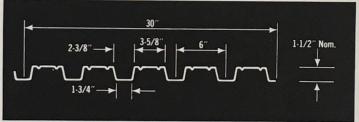
Type B and BW Steel Roof Deck

All deck sheets 7 feet or longer are swaged 3 inches for smooth end lap unless otherwise noted. Sheets under 7 feet are not swaged except by special arrangements.

#### Type B



## Type BW



SECTIONAL PROPERTIES, TYPE B & BW

Droportion	Gage							
Properties	22	20	18	16				
Weight Painted, PSF	1.88	2.26	3.02	3.79				
Weight Galvanized, PSF	1.95	2.34	3.10	3.87				
Section Modulus, in.3	.222	.275	.365	.455				
Moment of Inertia, in.4	.216	.260	.347	.435				

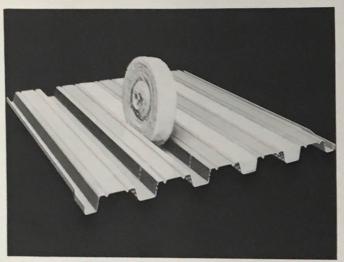
(Approximate weights for design purposes)

#### SAFE UNIFORM TOTAL LOAD - PSF

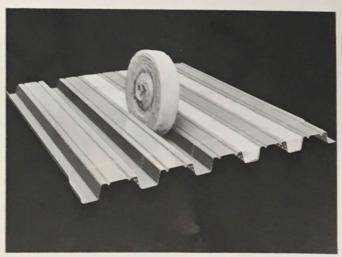
Number of Spans	Gage	4′0″	4'6"	5′0″	5′6″	6′0″	6′6″	7′0″	7′6″	8′0″	8'6"	9'0"	9'6"	10'0"
	22	153	121	98	78	62	51	43	37	32	28			
	20	206	163	126	97	77	63	52	44	38	34	30		
1 Span	18	293	232	188	139	109	88	73	61	52	45	39	35	31
	16	376	297	241	181	142	114	93	77	66	56	49	43	38
	22	185	146	119	98	82	70	61	53	46	41	37	33	30
	20	229	181	147	121	102	87	75	65	57	51	45	41	37
2 Span	18	304	240	195	161	135	115	99	86	76	67	60	54	48
	16	379	299	243	200	168	143	124	108	95	84	75	65	58
	22	232	183	148	123	103	88	76	66	56	49	42	38	34
	20	287	227	183	152	127	109	93	77	66	56	49	43	38
3 Span	18	380	300	243	201	169	144	120	100	84	72	62	54	48
	16	474	374	303	251	211	179	149	123	103	87	75	65	58

# type B/BW sound-ASORB®

WHEELING/SUPER-RIB ACOUSTICAL ROOF DECK



TYPE B-Safe uniform total load-PSF refer to Page 5.



TYPE BW-Safe uniform total load-PSF refer to Page 5.

### Type B and Type BW

Designed to serve as an acoustical ceiling as well as a roof deck, these decks are identical to Super-Rib Type B and Type BW except the webs of the ribs are perforated with 5/32" diameter holes staggered 3/8" on center. The sound absorbing elements consist of rolls of glass fiber furnished by the Wheeling Corrugating Company, which are placed between the perforated webs at the jobsite by the roofing contractor.

Sound-Asorb Type B and Type BW Super-Rib Roof Decks absorb up to 75% of the sound which reach them, greatly decreasing noise reverberation and its subsequent ill effects.

All deck sheets 7 feet or longer are swaged 3 inches for smooth end lap unless otherwise noted. Sheets under 7 feet are not swaged except by special arrangements.

#### SOUND ABSORPTION DATA\*\*\* Authority: Riverbank Acoustical Laboratories

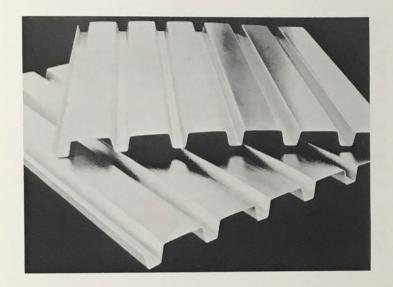
Coefficients								
125	250	500	1000	2000		Noise Red.		
.48	.87	.99	.81			Coeff.		
.37	.56	.80	.98			.75		
.41	.57	.82	.95			.70		
	.48	.48 .87	.48 .87 .99 .37 .56 .80	.48 .87 .99 .81 .37 .56 .80 .98	.48 .87 .99 .81 .36 .37 .56 .80 .98 .38	125     250     500     1000     2000     4000       .48     .87     .99     .81     .36     .27       .37     .56     .80     .98     .38     .23		

<sup>\*</sup>Whole assembly backed with glass fiber roof insulation 1 in, thick, weight 1.0 lb, per, sq. ft, 
\*\*Whole assembly backed with 1 in, thick rigid board insulation, weight 1.56 lb, per sq. ft,

orations do not reduce sectional properties of Type BW Deck.

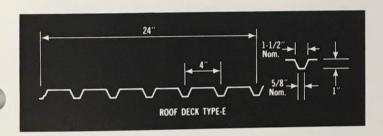
### type E/ES

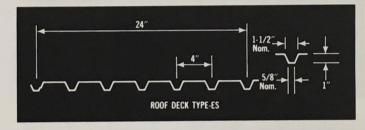
WHEELING/SUPER-RIB ROOF DECK



#### Type E and Type ES

Type E is an economy roof deck produced from light gage steel. It has been designed for short span roof deck construction, and is also adaptable for sidings. Sheets can be hand carried easily, which makes installation faster and labor costs lower. Whether attached by welding or mechanical fasteners, the  $1\frac{1}{2}$ " rib openings make connecting from above safer, quicker and easier. Type E deck is supplied in lengths from 8' to 38', with cover width of 24". Type ES is generally used for siding.





#### SECTIONAL PROPERTIES—TYPE E

	26 Ga.	24 Ga.
Weight Painted, PSF	1.06	1.41
Weight Galvanized, PSF	1.15	1.51
Section Modulus, in.3	.060	.083
Moment of Inertia, in.4	.036	.054

#### SECTIONAL PROPERTIES, TYPE ES

(Approximate weights for design purposes)

	26 Ga.	24 Ga
Weight Painted, PSF	1.11	1.47
Weight Galvanized, PSF	1.20	1.57
Section Modulus, in.3	.060	.083
Moment of Inertia, in.4	.036	.054

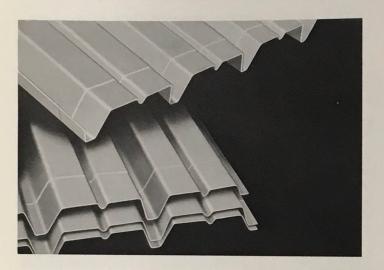
(Approximate weights for design purposes)

#### SAFE UNIFORM TOTAL LOAD - PSF

Number of	Gage	2′0″	2'6"	3′0″	3'6"	4'0"	4'6"	5′0″	5'6"	6'0"
Spans 1 Span	26	200 276	128 177	89 123	63 89	45 62	34 46	27 36	22 29	19 24
2 Span	26	200 276	128 177	89 123	65 90	50 69	40 55	32 44	26 37	22 31
3 or more	24 26 24	250 346	160 221	111 154	82 113	63 86	49 68	40 55	33 46	28 38

## type F

#### WHEELING/SUPER-RIB ROOF DECK



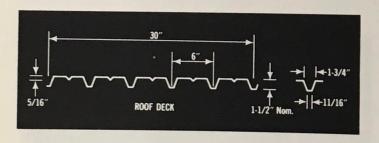
#### Type F Steel Roof Deck

This deck has been designed with optimum flute opening to allow for the most economical insulation. The full sidelap construction limits side-lap distortion and prevents bitumen drippage.

Type F can be nested during shipment and storage, thus assuring safe shipment while saving money by reduction of storage space costs. Sheets, 30" wide and up to 42' long, permit faster placement of material, more area covered with fewer laps and end welds. Rib openings allow fast and easy welding.

All deck sheets 7' 0" or longer are swaged 3" for smooth end lap.

Note: Type F Deck is also available without the rib stiffener from our Lenexa, Kansas plant.



#### SECTIONAL PROPERTIES, TYPE F

Properties		Gage	3000
rioperues	22	20	18
Weight Painted, PSF	1.73	2.08	2.77
Weight Galvanized, PSF	1.81	2.16	2.85
Section Modulus, in.3	.139	.167	.221
Moment of Inertia, in.4	.146	.176	.235

(Approximate weights for design purposes)

#### SAFE UNIFORM TOTAL LOADS, TYPE F

Span Condition	Gage	5′0″	5′6″	6′0″	6'6"	7′0"	7′6″	8'0"	8'6"	9′0″	0/0/	10'0"
1 Span	22 20 18	74 83 115	61 68 95	51 57 80	44 47 65	38 40 54	33 35 46	30		90	9′6″	10.0
2 Spans	22 20 18	74 89 118	61 73 98	51 62 82	44 53 70	38 45 60	33 40 52	35	35	31		
3 or more	22 20 18	93 111 148	77 92 122	64 77 103	55 66 87	47 57 75	41 49 66	46 36 43 58	32 38 51	36	31	

The amount of dead load included is 10 PSF. All loads are governed by the allowable flexural stress limit of 20 KSI. Live load deflection does not exceed 1/240th of the span.

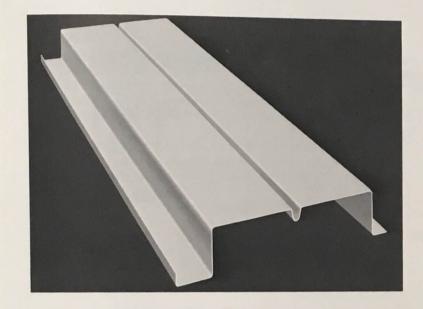
Spen length assumes center-to-center spacing of supports. Tabulated loads shall not be increased by assuming clear span dimensions.

Normal installations covered by this table do not require midspan fasteners for spans of 7 ft. or less.

The rib width limitations shown for intermediate rib are taken at the theoretical intersection
points of the flange and web projections.



WHEELING/SUPER-RIB ROOF DECK



### 4-3/8 7/8"-ROOF DECK

#### Type H Steel Roof Deck

When canopies, covered walkways, corridors or small structures require a single span section across an extended or larger span, Type H Roof Deck is ideal. It is available in standard depths of 3" and 41/2".

Type H can be supplied in lengths up to 22 feet covering 12" widths. For overhang design it can be cantilevered nominally.

#### CANTILEVER TABLE, H-DECK

Туре	Cantilever in Feet
30H22	3'6"
30H20	4'3"
30H18	5′3″
30H16 45H20	6′3″ 6′0″
45H18	7′6″
45H16	8′9″

#### SECTIONAL PROPERTIES, TYPE H

			0	Section	Moment	Weig	Weight, PSF		
Style	Depth	Cover	Gauge	Modulus Inertia		Painted	Galvanized		
30H22 30H20 30H18 30H16 45H20 45H18 45H16	3" 3" 3" 4½" 4½" 4½"	12" 12" 12" 12" 12" 12" 12"	22 20 18 16 20 18 16	.3699 .5036 .702 .899 .8624 1.202 1.550	.6768 .8719 1.317 1.778 2.222 3.338 4.508	2.19 2.65 3.48 4.40 3.00 3.93 4.97	2.31 2.77 3.60 4.53 3.13 4.07 5.11		

(Approximate weights for design purposes)

#### SAFE TOTAL LOAD - SINGLE SPAN WL/8 - POUNDS PER SQUARE FOOT

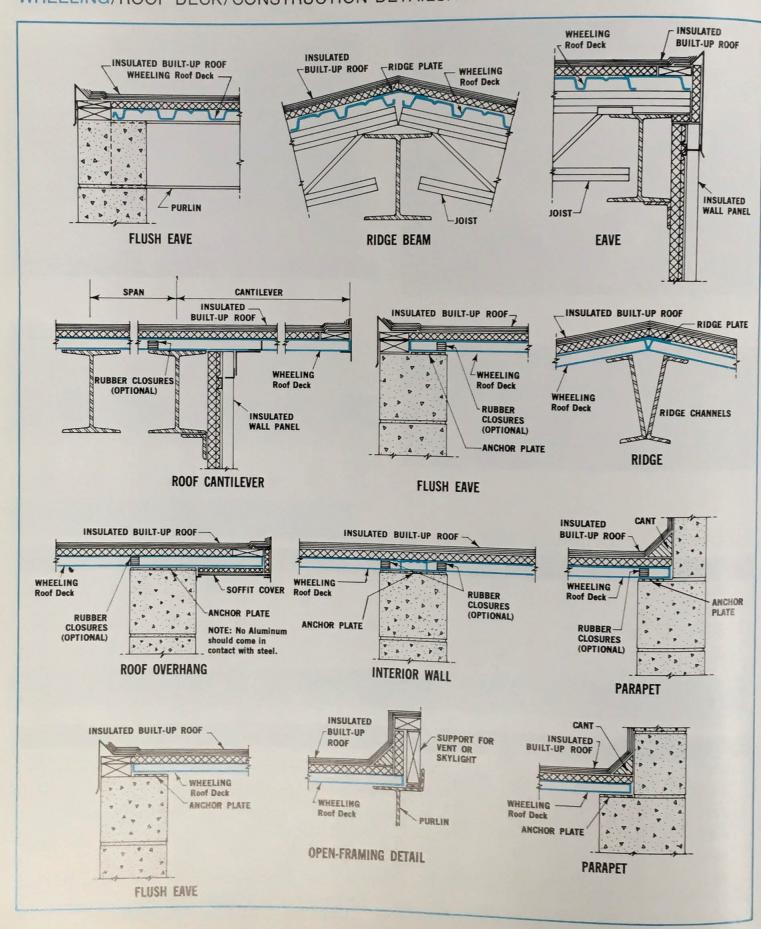
Style	10'	10'6"	11'	11'6"	1	2'	12′6″	13′	13'6"	14′	14'6"
30H22	53	47	43	39		36	33				
30H20	67	59	53	47		43	39	36	33	31	28
30H18	96	85	75	67		60	54	49	45	42	38
30H16	127	111	98	87		77	70	63	57	52	48
45H20	115	105	95	87		80	74	68	63	59	55
45H18	113	100		121	1	11	103	95	88	82	76
								122	113	105	98
45H16 Style	15'	15'6"	16'	16'6"	17′	17′6′	18′	18′6′	19'	19'6"	20′
30H20	27										
30H18	36	33	31	29	27						
30H16	45	41	38	36	34	27	35	33	31	30	28
45H20	51	48	45	42	39	37	46		41	38	36
45H18	71	67	63	58	55	49			50	47	45
45H16	92	86	81	75	70	65	60	53	30	47	43

#### NOTES:

- Tabular loads will not produce stresses in excess of 20 KSI or deflection due to live load greater than 1/240th of the span. Dead load includes the weight of deck, insulation and built-up roof and is assumed to be 7.15 PSF plus weight of deck. Moment coefficient is ½ and deflection coefficient is 5/384 for single span design.
- 2. All loads are predicated on a 2" bearing at each end of span.
- 3. Maximum length of sheet is 22'-0" and a nominal cantilever is permissible—refer to your Wheeling Corrugating Company salesman for further information.

#### CONSTRUCTION DETAILS

WHEELING/ROOF DECK/CONSTRUCTION DETAILS/ACCESSORIES



#### WHEELING/ROOF DECK/CONSTRUCTION DETAILS/ACCESSORIES

#### ERECTION

Deck shall be placed in accordance with erection drawings. Sheets are factory cut with swaged ends. End laps shall be a minimum 2". Use snap chalk line at reasonable multiples for proper alignment. Deck not promptly erected shall be stored off the ground with one end elevated and protected from the elements with tarpaulin or other weatherproof covering.

Begin erection at indicated starting point. Position the first sheet as noted on the drawing with the die set end located away from the corner and upstanding hook end of side lap away from wall.

#### WELDING

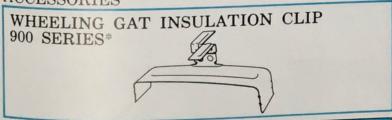
Electric arc welding is the best and most economical method for attaching Wheeling Deck to structural supports. Welder should follow close to placement crew, all sheets should be welded in place at end of working day. All welds are made from the top of the deck down through the ribs. Plug welds at side or end lap should penetrate all thicknesses of material and fasten all sheets to the structural supports. Care in selection of electrodes and amperage should always be exercised to insure positive attachment. Ends of deck to be welded to supports using a 12-6-12 pattern (a weld at each side lap and at the third and fourth flutes.) Intermediate supports; weld pattern, 12-18 staggered (a weld at each side lap, and at the third or fourth flute). If deck continuity is desired, side laps should be button punched, welded or screwed at mid span between supports.

#### REQUIRED MINIMUM INSULATION THICKNESSES

Class	Type A (Narrow)	Type B (Wide)	Type F (Intermediate)
Inorganic Glass Fiber	1/2 ***	1"* 3/4"**	3/4 *** 3/4 ***
Rigid Cellulose Fiberboard	1/2"	1"	1"
Cellular Glass Block	11/2"	1½"	1½"
Molded Expanded Polystyrene	5/8"	1"	5/8 "
Lightweight Expanded Perlite	3/4 "	1"	3/4" to 1"
Rigid Urethane Foam Panel		3/4"	5/8 "

<sup>\*</sup>Asphalt or paper faced

#### ACCESSORIES



Gat Deck Clips	Insulation	Weight
900-1 900-1.5 900-2 905-1 905-1.5 905-2 910-1 910-1.5 910-2	1" Insulation Style F 1-1/2" Insulation Style F 2" Insulation Style F 1" Insulation Style A 1-1/2" Insulation Style A 2" Insulation Style A 1" Insulation Style BW 1-1/2" Insulation Style BW 2" Insulation Style BW	8.5# C pcs. 9.0# C pcs. 9.5# C pcs. 9.2# C pcs. 9.7# C pcs. 10.2# C pcs. 8.0# C pcs. 8.5# C pcs. 9.0# C pcs.

#### CANTILEVER TABLES\*

1	YPE A	DECK	TYPE	B AND	BW DECK	TYPE F DECK			
Gage	Parent Span	Cantilever	Gage	Parent Span	Cantilever	Gage	Parent Span	Cantilever	
22	6'3"	17"	22	7′6″	27"	22	6'6"	191/8"	
20	7′0″	20"	20	8'6"	33"	20	7′0″	221/4"	
18	8′3″	26"	18	10'0"	43"	18	8′0″	265/8"	

<sup>\*</sup>Loads will not produce stresses in excess of 20 KSI based on 45 PSF total uniform loads plus 100 lbs. concentrated at end of cantilever.

- All strength calculation based on 45 PSF uniform load and 100 pounds concentrated load at end of cantilever.
- 2. All deflection calculation based on 35 PSF uniform load.
- 3. Cantilever and interior spans are not a straight line function, therefore any variations from the table should be calculated.

#### FIRE RESISTANT RATINGS FOR STEEL ROOF DECK

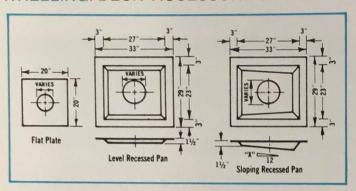
Hours	Protection	Insulation	Authority
2	1/8" Lightweight Aggregate Gypsum Plaster on Metal Lath	Min. 1" U.L. Listed Mineral Fiber Insulation Board	U.L. Design P404
2	1" Vermiculite-Gypsum Plaster on Metal Suspended Ceilings,	Min. ¾" U.L. Listed Fiber- glass Insulation Board	U.L. Design P409
1½	Min. 1%"-1½" Direct Applied Sprayed Vermiculite Plaster U.L. Listed	1" U.L. Listed Mineral Fiber Board Applied in Two Layers of ½" Board with Joints Staggered.	U.L. Design P703
1	%" U.L. Listed Acoustical Lay-in Boards and U.L. Listed Ceiling Grid	¾" U.L. Listed Mineral Fiber Insulation Board	U.L. Design P201
1	Min. 1¾"-1½" Direct Applied Sprayed Vermiculite Plaster U.L. Listed	1" U.L. Listed Mineral Fiber Insulation Board	U.L. Design P701
1	%" Ceramic Acoustical Lay- in Boards in Ceiling Grid U.L. Listed	1" to 3" U.L. Listed Mineral Fiber Insulation Board.	U.L. Design P211 P210
1	%" Listed Acoustical Lay-in Boards in U.L. Listed Ceiling Grid.	1" Listed Mineral Fiber Insu- lation Board	FM Design FC 37 1 Hr.

#### SUGGESTED SPECIFICATIONS FOR INSULATION CLIPS

- 1. Include in steel roof deck specifications:
  - "The steel deck supplier shall provide, along with Wheeling Steel Roof Deck (Type . . . . ) sufficient quantity of Wheeling Insulation Clips (Type . . . . ) to meet design uplift requirements of psf . . . . . He shall also supply Wheeling Clip installation tools. Clips shall be placed by the insulation contractor. (See Chart.)"
- Include with insulation and built-up roofing specification:
  - "One or one and a half inch rigid board insulation shall be applied dry to roof deck and securely fastened with Wheeling Insulation Clips. The insulation contractor shall install sufficient quantity of clips to meet design uplift requirements of .....PSF (See Chart.) Clips shall be furnished by the steel deck supplier.

<sup>\*\*</sup>Paper both sides.

#### WHEELING/DECK ACCESSORIES



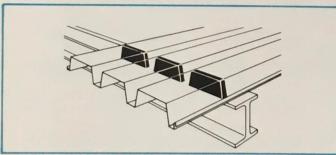
#### SUMP PANS AND PLATES

Galvanized steel, 14 gage. Three types to suit any roof sump requirement. Wide flanges permit secure welding to the steel deck. Cut holes as required in field.



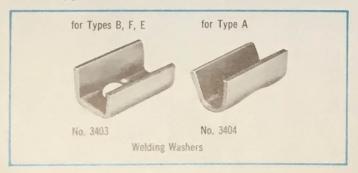
#### RIDGE AND VALLEY PLATES

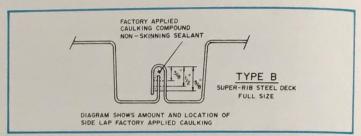
Plates should be used at ridges and valleys whenever the slope exceeds ½" per foot. They are normally supplied as 20 gage galvanized steel in 10'0" lengths.



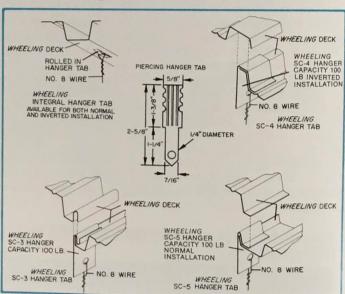
#### RUBBER CLOSURES

Flexible rubber closures seal the flutes of Types A, B, E, F, and H Roof Deck. They close the top of interior partitions when there is no ceiling below the deck and seal against weather where deck is cantilevered over exterior beams or walls. Closures are also available for the flutes on the top side of Types A, B, E, F and H Roof Deck.





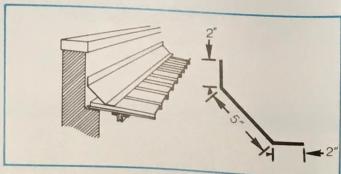
FACTORY APPLIED CAULKING (Class I Fire Rating) Factory applied caulking may be specified as shown. The caulking compound meets NAAMM Spec. 5C, 1.1, for nonskinning bulk compound. It will not form a hard exterior surface, will not run, will not flash at less than 750°F, and will remain pliable.



#### HANGER TABS

Wheeling Hanger Tabs are available for Type B and BW. The Hanger Tab is installed during deck erection, and hooked over the male leg before the female leg of the next deck section is placed over it. The Tab, because it protrudes from the underside, will not be covered up by the sprayed-on fireproofing.

Allowable load per tab: 100 pounds.



#### CANT STRIP

Cant strips are used in conjunction with parapet walls. They are normally supplied as 20 gage galvanized in 10'0" lengths.

#### Suggested Specifications

#### SOUND-ASORB ACOUSTICAL DECK

- Scope—This section of the specifications shall include all materials, equipment, and labor for installation of steel roof deck and roof deck accessories. Excluded are such items as deck supports, field paintings, flashing, gutter, poured saddles, or other such miscellaneous items specified elsewhere.
- 2. Material—Acoustical deck shall be Wheeling Type B or BW Sound-Asorb Super-Rib Acoustical Deck as manufactured by the Wheeling Corrugating Company, Wheeling, West Virginia. Webs shall be perforated with 3/32" diameter holes staggered 3/8" on center, Sound absorbing elements shall consist of glass fiber which can be fitted neatly into the void between the perforated vertical webs of the deck. This can be furnished in rolls or premolded in accordance with the producers standards. They shall be supplied by the Wheeling Corrugating Company and installed by the roofing contractor. Where sound barriers are required at walls or beams as shown, they shall be 1" thick, soft composition rubberlike material formed to fit rib voids, and shall be furnished by the Wheeling Corrugating Company. Basic steel to be (choose one) . . . ASTM Designation A 611-70 Grade C (supersedes ASTM A 245-64T) for painted or ASTM Designation A 446-69 for galvanized. Type, gage and finish shall be as indicated on the drawings, or if not so specified, type and gage shall be those which conform to the following design provisions.
- 3. Design—Same as Super-Rib Roof Deck, except add "Noise Reduction Coefficients" (NRC) shall be as determined by an accredited testing laboratory and shall not be less than .70.
- 4. Shop Finish—(Select one)
  - a. Steel shall be thoroughly cleaned in a chemical bath, followed by a rinse, phosphatized, rinsed, dried and properly prepared for painting. After phosphatizing, the surface shall be roller coat painted to insure an even protective covering with a gray flexible primer which when oven cured, shall have a moderate reflectance value.
  - b. Galvanized steel deck shall be structural Grade C standard black gage coated before fabrication in continuous strip by the Cook-Norteman process. Coating shall conform to ASTM A-525 Class G90 or QQ-5-775 Class d. or ASTM G01.
- Accessories—Ridge and valley plates, cant strips, saddles, sump plates shall be supplied as required on contract drawings.
- 6. Installation—Deck shall be anchored by welding directly through the bottom of the rib to all structural supports. Spans exceeding 7'-0" side laps shall be fastened together at mid span by button punching, and/or mechanical fasteners. Sound absorbing elements, sound barriers (and insulation clips, if required) as provided by the steel deck manufacturer shall be installed by the roofing or insulation contractor under the proper section of these specifications.

Roofing Section—Sound absorbing elements for steel deck shall be furnished by the roof deck manufacturer

#### WHEELING/ROOF DECK SPECIFICATIONS

and installed by the roofing contractor. They shall consist of elements for installation in all voids where perforations occur and shall extend the full length of the acoustical metal deck. Sound barriers (closure blocks) shall be provided by the deck manufacturer and installed in all ribs and voids, as specified in paragraph

#### SUPER-RIB ROOF DECK

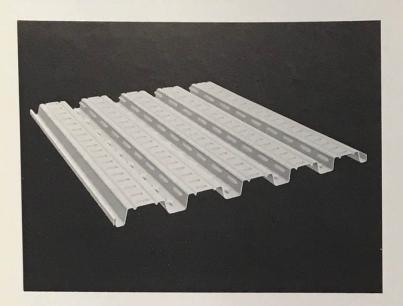
- Scope—This section of the specifications shall include all materials, equipment, and labor for installation of steel roof deck and roof deck accessories. Excluded are such items as deck supports, field paintings, flashing, gutter, poured saddles, or other such miscellaneous items specified elsewhere.
- 2. Material—Steel deck shall be Wheeling Super-Rib (specify Type A, Type E, Type F, Type B or Type BW.) as manufactured by Wheeling Corrugating Company, Wheeling, West Virginia. Basic steel to be (choose one) . . . ASTM Designation A 611-70 Grade C (supercedes ASTM A 245-64T) for painted or ASTM Designation A 446-69 for galvanized. Type, gage and finish shall be as indicated on the drawings, or if not so specified, type and gage shall be those which conform to the following design provisions.
- 3. Design—Basic steel shall be flat rolled carbon steel sheets of structural quality. The maximum design stress shall not exceed 20 KSI under total dead and live load of pounds per square foot. Properties shall conform to AISI "Specification for the Design of Cold Formed Steel Structural Members" latest edition. Where possible sheets shall extend over three or more supports.
- 4. Shop Finish—(Select one)
- a. Steel shall be thoroughly cleaned in a chemical bath, followed by a rinse, phosphatized, rinsed, dried and properly prepared for painting. After phosphatizing, the surface shall be roller coat painted to insure an even protective covering with a gray flexible primer which when oven cured, shall have a moderate reflectance value.
- b. Galvanized steel deck shall be structural Grade C standard black gage coated before fabrication in continuous strip by the Cook-Norteman process. Coating shall conform to ASTM A-525 Class G90 or QQ-S-775 Class d or ASTM G01.
- Accessories—Ridge and valley plates, cant strips, saddles, sump plates shall be supplied as required on contract drawings.
- 6. Erection—The steel deck shall be placed in accordance with erection drawings. Each unit shall be placed on supporting steel framework and adjusted to final position before being permanently fastened. The unit shall be brought to proper bearing on the supporting beams.

Ends of deck to be welded to supports using a 12-6-12 pattern (a weld at each side lap and at the third and fourth flutes.) Intermediate supports; weld pattern, 12-18 staggered. (A weld at each side lap and at the third or fourth flute.)

When spans exceed 7'-0" side laps shall be fastened together at mid span using welds or screws for Type A, Type F, Type B, Type BW or button punching for Type B only.

## type B/BW SUPER-BOND®

WHEELING/FLOOR DECK



## 2·3/8" | 3·5/8" | 6" | 1·1/2" Nom.

#### Types B and BW Composite Decks

"Classified by Underwriters Laboratories, Inc."

Wheeling Super-Bond Types B and BW deck are wide ribbed sections which can be employed in a composite system to achieve efficient and economical use of steel and concrete. Super-Bond Decks are embossed and indented on the flanges and webs.

During the construction phase, Super-Bond Decks carry the full dead load of concrete. Shoring may be required on extended spans before the concrete cures and reaches its maximum strength, but the full live load is carried by the steel and concrete performing compositely.

Available in 30-inch widths and up to 42-foot lengths.

#### SECTIONAL PROPERTIES, SUPER BOND

Properties	Gage								
Froperties	22	20	18	16					
Weight Painted, PSF	1.88	2.26	3.02	3.79					
Weight Galvanized, PSF	1.95	2.34	3.10	3.87					
Section Modulus, in. <sup>3</sup>	.227	.274	.366	.459					
Moment of Inertia, in.4	.216	.260	.346	.433					

(Approximate weights for design purposes)

#### MAXIMUM SPAN LENGTH—1 or 2 Spans (No Shoring)

SLAB	31/	2"	4	"	41	½"	43,	4"		5"	51/	5"	6	<i>II</i>
t	S	L	S	L	S	L	S	L	S	1	S	1	c	1
Wt.	33	26	39	30	45	35	48	37	51	39	56	45	61	49
Gage										00	30	43	01	43
22	7′0″	7′0″	6'6"	6′6″	6′0″	6'6"	6′0″	6′6″	6′0″	6'6"	6′0″	CICII	C/O#	6′6″
20	8′0″	8′0″	8'0"	8′0″	7′6″	7′6″	7′6″	7′6″	7′0″	7′0″		6′6″	6′0″	
18	9′0″	9'6"	8'6"	9'6"	8'6"	9'6"	8'6"	9'0"	7'6"		6′6″	7′0″	6′6″	6′6″
16	10'0"	11'6"	10'0"	11'6"	9'6"	11'0"	9'6"	10'6"		8′6″	7′0″	8′0″	7′0″	7′6″
10	100	110	100		00	110	30	10.0	8'6"	10'0"	8′0″	8'6"	7'6"	8'0"

#### MAXIMUM SPAN LENGTH-3 or More Spans (No Shoring)

SLAB	31/	2"	4	"	41/	2"	43,	4"	-	5"				
	9		S		9		c				5	/2"	6	"
	3				0		3		S	L	S		S	L
Wt.	33	26	39	30	45	35	48	37	51	39	56	1E		49
Gage											30	45	61	45
22	7′6″	7'6"	7′0″	7′0″	6'6"	7′0″	6'6"	7′0″	6'6"	7/0#				
	8'6"	8'6"	8'6"	8'6"	8′0″	8′0″	8'0"			7′0″	6'6"	7′0″	6'6"	7′0″
20								8′0″	7'6"	7'6"	7′0″	7'6"	7′0″	7′0″
18	10'0"	11'0"	9'6"	10'6"	9'3"	10'0"	9'0"	9'9"	8'6"	9'6"				
16	11'6"	12'0"	11'0"	12'0"	10'6"	11'6"	10'3"	11'3"			8′0″	9′0″	7'6"	8′0″
10	110	12.0					100	11.3	9'9"	11'0"	9'3"	10'0"	8'6"	8'9"

NOTES: 1. Stone Concrete—145#/ft $^3$  Lightweight Concrete—110#/ft $^3$  All concrete to be f  $_{\rm C}$ =3,000 psi.

#### \*TOTAL SUPERIMPOSED LOADS—SUPER-BOND TYPE B & BW

22 GAGE

20 GAGE

18 GAGE

16 CACE

SPAN	LOADS									
Slab T	31/2	4	41/2	43/4	5	51/2				
6-0	250	250	250	250	250	250				
6-6	223	250	250	250	250	250				
7-0	188	237	250	250	250	250				
7-6	160	202	247	250	250	250				
8-0	136	173	211	231	250	250				
8-6	117	149	182	200	217	250				
9-0	101	129	158	173	188	220				
9-6	87	112	137	151	164	192				
10-0	75	97	119	131	143	168				
11-0	57	74	91	100	109	163				
12-0	43	56	69	77	84	100				

SPAN	LOADS										
Slab T	31/2	4	41/2	43/4	5	51/2					
6-0	250	250	250	250	250	250					
6-6	250	250	250	250	250	250					
7-0	225	250	250	250	250	250					
7-6	192	243	250	250	250	250					
8-0	165	209	250	250	250	250					
8-6	142	180	221	244	250	250					
9-0	123	157	193	212	231	250					
9-6	107	137	168	185	202	234					
10-0	94	119	147	163	177	206					
11-0	72	92	114	126	138	160					
12-0	55	71	89	98	107	125					

SPAN			LO	ADS		
Slab T	31/2	4	41/2	43/4	5	51/2
6-0	250	250	250	250	250	250
6-6	250	250	250	250	250	250
7-0	250	250	250	250	250	250
7-6	250	250	250	250	250	250
8-0	220	250	250	250	250	250
8-6	187	233	250	250	250	250
9-0	158	199	250	250	250	250
9-6	134	169	229	250	250	250
10-0	114	145	202	221	242	250
11-0	86	109	160	174	191	224
12-0	66	83	127	139	153	179

	10	G	AG	L		
SPAN			LO	NDS		
Slab T	31/2	4	41/2	43/4	5	51/2
6-0	250	250	250	250	250	250
6-6	250	250	250	250	250	250
7-0	250	250	250	250	250	250
7-6	250	250	250	250	250	250
8-0	250	250	250	250	250	250
8-6	216	250	250	250	250	250
9-0	182	250	250	250	250	250
9-6	155	225	250	250	250	250
10-0	133	193	250	250	250	250
11-0	100	145	201	223	243	250
12-0	77	112	155	179	196	230

#### \* TOTAL SUPERIMPOSED LOADS—SUPER-BOND TYPE BW INVERTED

22 GAGE

	122	-
20	CA	CL
20	GA	UL

18 GAGE

16 GAGE

SPAN		LOADS								
Slab T	4	41/2	43/4	5	51/2	6				
6-0	250	250	250	250	250	250				
6-6	250	250	250	250	250	250				
7-0	250	250	250	250	250	250				
7-6	250	250	250	250	250	250				
8-0	219	250	250	250	250	250				
8-6	189	224	243	250	250	250				
9-0	164	195	211	227	250	250				
9-6	143	170	184	198	226	250				
10-0	125	148	161	173	198	223				
11-0	96	114	124	134	153	173				
12-0	73	88	96	103	119	135				

SPAN			LOA	NDS		
Slab T	4	41/2	43/4	5	51/2	6
6-0	250	250	250	250	250	250
6-6	250	250	250	250	250	250
7-0	250	250	250	250	250	250
7-6	250	250	250	250	250	250
8-0	250	250	250	250	250	250
8-6	231	250	250	250	250	250
9-0	201	239	250	250	250	250
9-6	176	210	227	244	250	250
10-0	155	184	200	215	246	250
11-0	120	144	156	168	192	217
12-0	94	113	123	132	152	172

SPAN	LOADS									
Slab T	4	41/2	41/4	5	51/2	6				
6-0	250	250	250	250	250	250				
6-6	250	250	250	250	250	250				
7-0	250	250	250	250	250	250				
7-6	250	250	250	250	250	250				
8-0	250	250	250	250	250	250				
8-6	250	250	250	250	250	250				
9-0	250	250	250	250	250	250				
9-6	234	250	250	250	250	250				
10-0	201	250	250	250	250	250				
11-0	151	203	217	234	250	250				
12-0	116	163	174	188	215	243				

SPAN	LOADS									
Slab T	4	41/2	4¾	5	51/2	6				
6-0	250	250	250	250	250	250				
6-6	250	250	250	250	250	250				
7-0	250	250	250	250	250	250				
7-6	250	250	250	250	250	250				
8-0	250	250	250	250	250	250				
8-6	250	250	250	250	250	250				
9-0	250	250	250	250	250	250				
9-6	250	250	250	250	250	250				
10-0	233	250	250	250	250	250				
11-0	175	237	250	250	250	250				
12-0	135	183	210	240	250	250				

#### RECOMMENDED TEMPERATURE REINFORCING

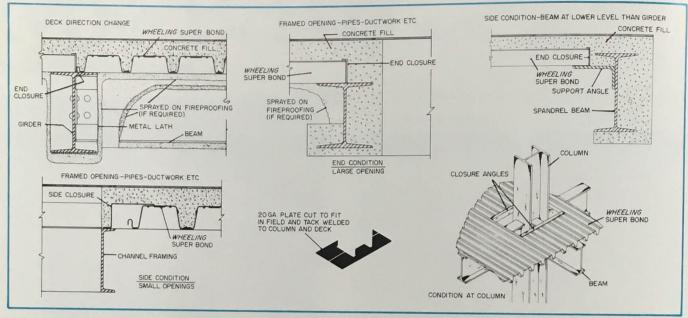
SLAB	4"	41/2"	5″
SPAN	TEMP	PERATURE REINFOR	CING
To 7'6"	6 x 6—10/10	6 x 6-10/10	6 x 6-6/6
7'6" to 8'6"	6 x 6-10/10	6 x 6-10/10	6 x 6-6/6
8'6" to 12'0"	6 x 6- 8/8	6 x 6- 8/8	6 x 6-6/6

NO INFORMATION PRESENTED HEREIN SHOULD BE USED TO REPLACE THE JUDGMENT OF EXPERIENCED STRUCTURAL ENGINEERS.

- 1. Welded wire fabric one inch below top surface of slab is recommended. No negative steel is
- 2. Calcium chloride admixtures or admixtures containing chloride salts shall not be added to the concrete.
- 3. The load tables may be used with the deck on simple or continuous spans. Composite slab design is based on simple span analysis. When the floor slab is continuous over three or more spans, the allowable superimposed loads can be increased by 1.25. Negative steel must be provided over the supports for this continuous condition.
- 4. Shoring requirements are determined as follows:
- Snoring requirements and determined as lonows;

  a. Dead load of concrete and deck plus 20 PSF construction load will not stress section greater than 20 KSI. If the construction load exceeds 20 PSF, the span and/or gage must be changed at the discretion of the design engineer.
- b. Dead load of concrete and deck will not cause simple span deflection greater than L/180
- 5. The loads in the table are for loads as used in building design. In structures or sections of buildings where live loads are kept on for a long time, the effect of creep should be taken into account. When Super-Bond is used on industrial type floors, the loading conditions should be thoroughly investigated. Live load deflection limited to L/360.
- When shoring is used, deduct the dead load from the loads as shown in the tables to obtain the Total Superimposed Load.
- \*7. The Total Superimposed Loads have been limited to 250 PSF. Loadings of greater magnitude usually indicate heavy concentrated moving loads for which additional negative and transverse reinforcing may be required. Contact your Wheeling Corrugating Company District Office for more information.

#### WHEELING/FLOOR DECK/CONSTRUCTION DETAILS



#### CONCRETE VOLUME / Volume of Fill Per 100 Sq. Ft.

Super	-Bond	BW Super-Bond Inverted						
Slab Thickness	Volume of Fill	Slab Thickness	Volume of Fill					
3½"	.80 cu. yds.	3½"	.90 cu. yds.					
4"	.95 cu. yds.	4"	1.05 cu. yds.					
4½"	1.10 cu. yds.	4½2"	1.20 cu. yds.					
5"	1.25 cu. yds.	5"	1.35 cu. yds.					
5½"	1.40 cu. yds.	5½"	1.50 cu. yds.					
6"	1.55 cu. yds.	6"	1.65 cu. yds.					

#### FIRE RATINGS— SUPER-BOND COMPOSITE DECK

Design Number	Floor Rating	Beam Rating	Concrete Cover	Type Concrete	Remarks
D840	0.11-	1½ Hr.	01/#		
D640	2 Hr.	Unrestrained	31/4"	Lt. Wt.	
D826	2 Hr.	1, 1½, 2 Hr. Unrestrained	31/4"	14 14/4	
0020	2 111.		374	Lt. Wt.	
D710	2 Hr.	1 Hr. Unrestrained	21/2"	Reg. Wt.	Fireproofing Reqd.
D000	0.11	1½ Hr.			
D902	3 Hr.	Unrestrained	43/16"	Lt. Wt.	
	2 Hr.	1½ Hr.	A1///	D W/4	
	Z mi.	Unrestrained 1½ Hr.	4½"	Reg. Wt.	
	1½ Hr.	Unrestrained	4"	Reg. Wt.	
		1½ Hr.			
	1 Hr.	Unrestrained	31/2"	Reg. Wt.	

1. Depth of concrete above top of composite deck unit.

The above table is a brief listing of the most popular fire rated assemblies. Refer to the U.L. Fire Resistance Index for construction details on other approved assemblies.

#### Suggested Specifications

#### SUPER-BOND FLOOR DECK

 Scope—This section of the specifications shall include all materials, equipment, labor and services necessary for the installation of Wheeling Super-Bond floor deck, complete in accordance with this specification and where shown or called for on the architectural or structural drawings.

#### 2. Work Not Included -

- a. Concrete (minimum compressive strength 3000 psi).
- b. Concrete reinforcing steel or temperature mesh.

- c. Structural steel and/or other miscellaneous bracing or supports for the steel floor units.
- d. Fireproofing.
- 3. Materials—The Super-Bond composite deck shall be as manufactured by Wheeling Corrugating Company, Wheeling, West Virginia, from steel conforming to ASTM A-611-70C (supercedes ASTM A245-64T) with a minimum yield strength of 33 KSI.

Galvanized steel deck shall be coated before fabrication in continuous strip by the Cook-Norteman process and conform to ASTM A525-71 Class G90 and federal specification QQ-S-775 Class d. Also available with ASTM A525-71, Class G01.

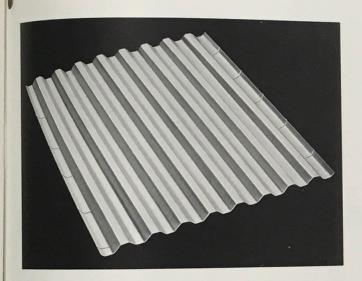
#### 4. Design

- a. Properties of the steel floor units shall conform to the American Iron and 'Steel Institute, "Specification for the Design of Cold-Formed Steel Structural Members", latest edition.
- b. Composite floor units shall be capable of supporting a superimposed load of pounds per sq. ft. and a dead load of pounds per sq. ft.
- c. Superimposed live loads shall not cause the composite section to deflect more than 1/360 of the span.
- 5. Accessories—Where required or shown on the plans:
  - 1. Provide cover plates or closure angles as required to close deck end conditions where deck changes direction.
  - 2. Furnish material for column closures to close openings between deck and structural columns.
- 6. Erection—The steel deck shall be placed in accordance with erection drawings. Each unit shall be placed on supporting steel framework and adjusted to final position before being permanently fastened. The unit shall be brought to proper bearing on the supporting beams.

Ends of deck to be welded to supporting beams, pattern (a weld at each side lap and at the third and fourth flutes.) Intermediate supports; weld pattern, 12-18 staggered. (A weld at each side lap and at the third or fourth flute.) Side laps shall be fastened at max. 3'-0" centers between supports.

## tensiform 50, 75, 125 and 200

WHEELING/PERMANENT FORMS



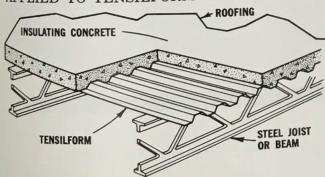
#### Wheeling Tensilform®

Tensilform is an ideal, self-sustaining form for conventional reinforced concrete slabs and a strong structural support for lightweight aggregate or foamed insulating fills. High strength, Durable Tensilform has minimum yield strengths of 80 ksi and upwards, and can serve as a permanent steel base for concrete floors and roof slabs.

When desired as a permanent support, Tensilform should be specified with galvanized finish. If permanence is not essential, then uncoated Tensilform may be specified. However, galvanized Tensilform is always required when it is to function as a structural support for lightweight aggregate or foam insulating fill.

STANDARD SHEETS AVAILABLE 7' TO 38'.

#### INSULATING CONCRETE APPLIED TO TENSILFORM



#### ADVANTAGES

Structurally — Tensilform provides a high quality, strong, structural section to sustain slabs; and it gives lateral

Heating and Air Conditioning — Its excellent "U" factor with lightweight roofing fills means a savings in heating and air and

and air conditioning costs. Concrete Floors — The Tensilform configuration saves substantial concrete compared with less rigid centering. Fire Ratings — Tensilform provides for a two, three or

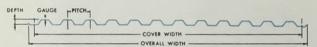
four hour rating with plaster ceiling. Uniform Fit — Sides and ends are designed for overlapping with a close, neat fit to reduce welding time.

Speeds Construction — Provides an immediate working surface for other trades; protects workmen on lower levels. Permanent Form — Does not have to be removed

non-permanent forms do. Pre-Vented—Tensilform sheets are furnished with a builtin vent feature eliminating the necessity of using separate vent clips.



#### WHEELING/PERMANENT FORMS



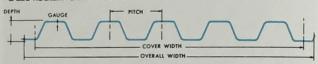
#### TENSILFORM 50



TENSILFORM 75



#### TENSILFORM 125



TENSILFORM 200

#### TABLE 1—PHYSICAL PROPERTIES PER FOOT WIDTH

Description	Units	TF-50	TF-75	TF-125-26	TF-125-24	TF-125-22	TF-125-20	TF-200-22	TF-200-20	TF-200-18	TF-200-16
Nominal Pitch Nominal Depth Gage No. Weight Uncoated	Ins. Ins. — psf	2½ 9/16 28 .78	3 <sup>3</sup> / <sub>4</sub> 1 <sup>5</sup> / <sub>16</sub> 25 1.04	5 1 <sup>5</sup> / <sub>16</sub> 25	5 1 <sup>5</sup> / <sub>16</sub> 24 1.34	5 1 <sup>5</sup> / <sub>16</sub> 22 1.67	5 1 <sup>5</sup> ⁄ <sub>16</sub> 20 2.01	6 2 22 1.89	6 2 20 2,27	6 2 18 3.02	6 2 16 3.78
Weight Galvanized Nominal Cover Width Nominal Overall Width	psf Ins. Ins.	.86 30 31 <sup>1</sup> / <sub>4</sub>	1.13 30 31 <sup>3</sup> / <sub>4</sub>	1.18 30 32½	1.44 30 32½	1.78 30 32½	2.01 2.11 30 32½	2.01 30 313/8	2.38 30 31 <sup>3</sup> / <sub>8</sub>	3.12 30 313/8	3.83 30 313/8
Moment of Inertia Section Modulus Min. Yield of Virgin Steel	Ins.4 Ins.3 KSI	.012 .036 95	.038 .078 90	.07549 .10936 90	.093 .137 80	.117 .174 80	.140 .208 80	.302 .254 80	.378 .324 80	.532 .474 80	.684 .631 80

NOTES:
The physical properties represented in this table were computed in accordance with specifications section in the latest edition of the "Light Gage Cold-Formed Steel Design Manual" as published by the American Iron and Steel Institute.

#### TABLE 2-MAXIMUM ALLOWABLE LOADS-

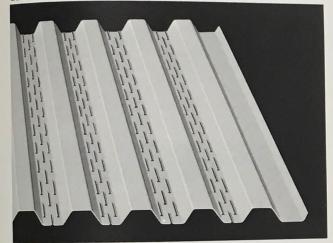
#### THREE SPAN CONDITION—PSF (FOR USE AS FORM MATERIAL ONLY)

Clear Span	Design Co	ndition	3'0"	3'6"	4'0"	4'6"	5'0"	5'6"	6'0"	6'6"	7′0″	7'6"	8'0"	8'6"	9'0"	9'6"	10'0"	10'6"	11'0"	11'6"	12'0"
TF-50	Stress Deflection	30000 1/240 1/180	100 54 72	74 34 45	56 23 30	45 16 21	36 12 16														
TF-75	Stress Deflection	30000 1/240 1/180	216 171 216	156 108 144	121 72 96	96 51 68	78 37 49	64 28 37	54 21 29	46 17 22	40 13 18										
TF-125-26	Stress Deflection	30000 1/240 1/180	304 304 304	223 215 223	171 144 171	135 101 134	109 74 98	90 55 74	76 43 56	65 34 44	56 27 36	49 22 30	43 18 24								
TF-125-24	Stress Deflection	30000 1/240 1/180	381 381 381	280 265 280	215 178 215	170 125 166	137 91 121	114 68 91	95 53 70	81 41 55	70 33 44	61 27 36	54 22 30								
TF-125-22	Stress Deflection	30000 1/240 1/180		355 332 355	272 223 272	215 157 208	174 114 152	144 86 114	121 66 88	103 52 69	89 42 55	77 34 45	68 28 37								
TF-125-20	Stress Deflection	30000 1/240 1/180			325 325 325	257 188 250	208 137 183	172 103 137	145 79 106	123 62 83	106 50 67	93 41 54	81 33 45								
TF-200-22	Stress Deflection	30000 1/240							176 171	150 134	129 108	113 87	99 72	88 60	78 51	70 43	63 37				
TF-200-20	Stress Deflection	30000 1/240									165 134	144 109	127 90	112 75	100 63	90 54	81 46	74 40	67 35		
TF-200-18	Stress Deflection	30000 1/240											185 127	164 105	146 89	131 76	119 65	108 56	98 49	90 43	82 38
TF-200-16	Stress Deflection	30000 1/240														175 97	158 83	143 72	130 63	119 55	110 48

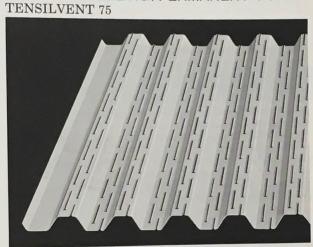
- 1. Values shown are for base sheet only and do not include any value supplied compositely by insulation fill or poured slab.
- 2. Values for stress are based on M =  $\frac{wL^2}{10}$  x 12 = fS with f limited to 30 KSI.
- 3. Values for deflection are based on D max, =  $\frac{.00688 \text{ w}_1 \text{ L}^4}{F_1} \times 1728 \text{ with D max}$ , listed at 1/240 and 1/180 and stress limited to 30 KSI.
- 4. Values are for total allowable loads in psf and include weight of deck

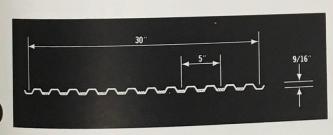
## tensilvent 50 and 75

TENSILVENT 50

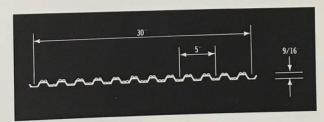


WHEELING/PERMANENT FORMS





STANDARD SHEETS AVAILABLE 7' TO 38'.



#### Wheeling Tensilvent

Wheeling Tensilvent is a structural support for lightweight decks. It has all of the physical characteristics and advantages of Tensilform #50 and #75, plus the advantage of maximum drying time. The vent perforations of Tensilvent provide a total open area of 3% for venting and release of vapor pressure.

Physical properties per foot width for Tensilvent 50 and 75 are identical to those for Tensilform. See Table 1, page 18.

### THREE SPAN CONDITION — PSF (FOR USE AS FORM MATERIAL ONLY)

THREE SPA	N CONDITION -	PSF (FOI	- 12/1	2'6"	3'0"	3'6"	4 0	4 0	3.0
	Design Condition	1'6"	20		100	74	56	45	36
Clear Span	Stress—30 KSI Deflection 1/360	407 287 *407	226 121 182	62 93 124	36 54 72	23 34 45	15 23 30	11 16 21	8 12 16
TF-50	1/240 1/180 1/120	*407 *407	*226 *226	*145	*100	68	45	32	23 7′0″

Clear Span         Design Condition         3'0"         3'6"         4'0"         4 0         78         64         54         46         40           Stress—30 KSI         216         156         121         96         78         64         54         46         40           TF-75         Deflection 1/240         171         108         72         51         37         28         21         17         13           18         144         96         68         49         37         29         22         18		1/120	407			A/C#	5′0″	5'6"	6'0"	6'6"	//0"	
Design Condition         216         156         121         96         72         51         37         28         21         17         13           TF-75         Deflection 1/240         171         108         72         68         49         37         29         22         18			3'0"	3'6"	4′0″	4′6″		64	54	46	40	
TF-75 Deflection 1/240 171 108 72 68 49 37 29 22 15	Clear Span	The state of the s		156		-		28				
	TF-75	Deflection 1/240 1/180	171 216						29	22	10	

<sup>\*</sup>Stress Governs

Values for Deflection are based on D max  $=\frac{0.0688W_1L^4}{E_-l} \times 1728$ 

With D max listed at 1/360, 1/240, 1/240, 1/180 and 1/120 and stress limited to 30 KSI

#### WHEELING/TENSILFORM/CONSTRUCTION DETAILS

#### How to Calculate Deflection

How to calculate deflection for a given load and span. Follow curved line until it intersects another line projected vertically from the given load for the style Tensilform desired. Assume a line horizontally from the intersection point to the specified erection design at left side of chart and read deflection decimally. Use scale conversion chart to convert decimals to fractions of an inch.

How to select style of Tensilform to sustain a given load across a specified span. Locate the limiting deflection according to design conditions and project a line horizontally until it intersects the span line. Drop another line vertically downward and select the style that most effectively carries given loading.

Selecting the most economical span for design. Draw a line vertically from the point representing the required load for the Tensilform style being considered. Project another line horizontally from the allowable deflection for construction being considered. At the point of intersection, determine the most economical span by visual estimate.

#### DEFLECTION

Allowable Deflection

#### Based on Uniformly Loaded Spans TYPE OF SPANS Dual Single or Multiple (welded) (Conventiona design) Multiple Loads imposed on various styles of TENSILFORM Fixed Free End (Pounds per Square Foot) End 650 225 4'-0 100 450 550 400 450 150 3'-6 125 100 500 250 200 075 3'-0 150 050 100 2'-6 100 TENSILFORM 50 10 15 40 50 60 70 80 90 100 120 150 170 200 75 50 60 70 80 90 100 120 150 170 200 125-24 -40 50 60 70 80 90 100 120 150 170 200 125-22 30 50 60 70 80 90 100 120 150 170 200

#### DEFLECTED LIMITATIONS

Conventional design of Tensilform is normally based on uniformly loaded dual span with free ends at supports.

Where deflection is limited, a 1/240 of the span deflection limitation is usually stated or implied. When making selections as outlined above, refer to Limit Table below to determine what 1/360, 1/240 or 1/180 deflection limitation implies decimally for the span under consideration.

#### LIMIT TABLE

	Deflection equivalents in decimals of an inch.											
Span	1/360	1/240	1/180	Span	1/360	1/240	1/180					
2'0"	.067	.100	.133	6'0"	.200	.300	.400					
2'6"	.083	.125	.167	6.6"	.217	.325	.433					
3'0"	.100	.150	.200	7′0″	.233	.350	.467					
3'6"	.117	.175	.233	7'6"	.250	.375	.500					
4'0"	.133	.200	.267	8'0"	.267	.400	.533					
4'6"	.150	.225	.300	8'6"	.283	.425	.567					
5'0"	.167	.250	.333	9'0"	.300	.450	.600					
5'6"	.183	.275	.367									

Conversion scale decimals to fraction-inches

050 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000

125-20 -

#### ERECTION & WELDING

Place Tensilform sheets end-to-end beginning at corner of building, maintaining alignment. When one row is placed end-to-end, begin another, making alignment adjustments if necessary. Place sheets with edges up and end lapped to a minimum of 2 inches for welded construction or top chord width for clip attachment. Center end laps over supports and make side lap one-half corrugation.

Sheets shall be attached to supports by welding through Wheeling Welding Washers. Minimum welding require-

ments are as follows:

a. End laps—each lap is fastened using a weld washer at each side lap plus one intermediate weld (3 welds per sheet).

b. Intermediate supports—weld sheet at side laps at each intermediate support.

Self-tapping screws may also be used when erecting Wheeling Tensilform. For Diaphragm welding patterns, consult WHEELING DIAPHRAGM DESIGN MAN-UAL.

#### TENSILFORM ACCESSORIES

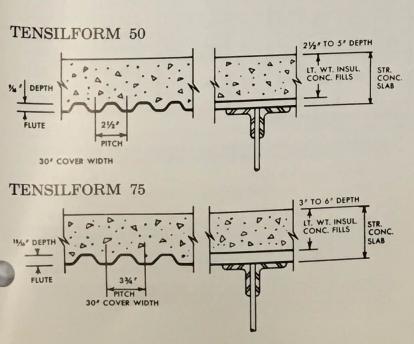


#### TABLE 3 VOLUME OF FILL PER SQ. FT.

DEFLECTION NOT CONSIDERED

Fill Over				
Top of Flute	TF-50	TF-75	TF-125	TF-200
21/2"	.232	.247	.266	.291
3"	.273	.289	.307	.333
31/2"	.315	.330	.349	.375
4"	.357	.372	.392	.416
41/2"	.398	.413	.432	.458
5"	.440	.455	.473	.500

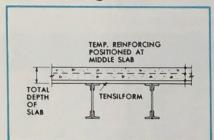
- 1. To determine total volume of fill in cu. ft... multiply number of square feet roof area by figure opposite depth of fill (above top of flute) for style of Tensilform being used.
- 2. To determine weight, multiply volume by wet density for poured construction load or by dry density for dead load of fill. Add weight of form mesh and/or built-up roof for dead load. Add live load to determine total load. Refer to Load Table, page 20 for form selection.
- 3. When an average depth is specified, use the decimal equivalent for feet and proceed as above, i.e. 21/2" average depth equals .2083 cu. ft. per one square foot of surface; 3" equals .2500, etc.



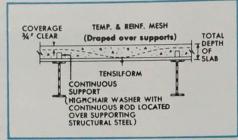
#### TENSILFORM 125 LT. WT. INSUL. STR. 15/4" DEPTH FLUTE PITCH (NOMINAL) 30" COVER WIDTH TENSILFORM 200 3" TO 6" DEPTH 2" DEPTH LT.WT. INSUL PITCH (NOMINAL) 30" COVER WIDTH

#### WHEELING/TENSILFORM/CONSTRUCTION DETAILS

#### Slab Designs



Slab Design for 21/2" and 31/2": Slabs with spans up to 2'6"



Slab Design for slabs over 3" deep or spans over 2'6"

NEGATIVE MOMENTS (OVER SUPPORTS) POSITIVE MOMENTS (MID SPAN) TOP OF 11/2 x WIRE DIA DESIGN DEPTH +d FOR +M DEPTH OF SLAB DESIGN DEPTH REINFORCEMENT TENSILFORM REINFORCING MESH (DRAPED) DEPTH OF FLUTE REFER TABLE 1 TENSILFORM SHEET GA. OF

Interpretation of effective design depths.

#### TABLE 4 ALLOWABLE SAFE UNIFORM SUPERIMPOSED LOADS FOR STRUCTURALLY REINFORCED CONCRETE SLABS.

Load unit: lbs./sq. ft. Tensilform used as form material. Welded wire fabric used for reinforcement.

	Minimu Recommer				SA	FE UNI	FORM S	SUPERIN	MPOSED	LOAD	CAPACI	ITY OF	SLAB	(PSF)					
Overall	Reinforcer					1	For Vario	ous Spai	ns using	Tensilf	orm as o	entering						lab	Vol.
(total) Depth of	Wolded	Area	1'-6	2'-0	2′-6	3'-0	3′-6	4*-0	4'-6	5′-0	5′-6	6′-0	6'-6	7′-0	7′-6	8'-0	We	ight form)	of fill in cu.
Slab	Welded Wire	of Steel As-in <sup>2</sup>		use 7	TF-50		use TF-75			use TF-125-124			use TF- 125-22			Form	1	ft. per sq. ft.	
21/5"	6x6—10/10	.029	429	229	136	86											TF-50	29	.185
21/2"	6x6—6/6	.058	803	439	270	179	101	71									TF-75	27	.169
3"	6x6—10/10	.029	610	328	197	126	73										TF-50	35	.227
3"	6x6—6/6	.058	1165	640	397	265	162	116									TF-75	33	.211
	6x6—4/4	.080				481	310	228	172	117	90	70	54				TF-50	42	.268
31/2"	4x4—6/6	.087				539	349	258	196	134	105	82	64		37		TF-75	39	.253
	4x4—4/4	.120				730	475	355	272	189	150	120	97	77	61		TF-12	5 38	.237
	6x6—4/4	.080				603	395	292	221	156	121	95	75	57			TF-50	48	.310
4"	4x4—6/6	.087				672	445	330	251	178	139	110	87	68	53		TF-75	46	.294
	4x4—4/4	.120					605	453	348	251	200	161	131	105	85	69	TF-12	5 44	.279
	4x4—6/6	.087					540	402	306	222	174	139	111	88	69	55	TF-50	54	.352
41/2"	4x4—4/4	.120					741	555	428	313	250	202	165	134	109	90	TF-75		.336
5″	4x4—4/4	.120					873	654	505	375	301	244	197	163	133		TF-50 TF-75 TF-12	58	.393 .378 .362

Volume of fill calculated from bottom of flute. See Note 3 (b).

#### NOTES

- 1. a) Load values above are based on the use of uncoated Tensilform with the reinforced slab carrying entire load. When galvanized Tensilform is considered as permanent form, loads may be increased by the amount of the slab weight shown in next to last column.
  - b) Load values are for interior spans only and are based on M-wl2/12 per ACI (318-63) section 904
  - c) For loads using TF-200, contact your Wheeling Corrugating Company District Office.
- 2. Load values in this table were determined by the following: Effective slab depth (d) for positive or negative moment can be determined according to diagram above table.

 $f'_{c} = 2500 \text{ psi};$ 

 $p = A_s/bd$ 

n = 10

 $M_s = A_s f_s jd$ 

fc .= 1125 psi

 $k = \sqrt{2pn+(pn)^2}-pn$ 

b = 12 ins.

Mc=1/2fckjbd2

 $f_S = 30 \text{ ksi}$ 

j = 1 - k/3

3. a) Selection of forms for short span 2½" and 3" thick concrete slabs was made to sustain total slab dead load only while forms for concrete slabs exceeding 3" sustain total slab weight of 50 psf (whichever is greater). These stipulated dead loads will be sustained without form deflection exceeding 1/240th of the span or fiber stress exceeding 30 ksi. Weight of wet taken at all times to prevent concentrated loading and excessive buggy use over undersonable. Defaulting recommended.

b) Safe uniform superimposed load values for 2½" and 3" short span concrete slabs were determined on the same basis as the deeper slabs with mesh draped over supports. At designer's option, where mesh is to be located at middle of slab, loads should be reduced by 12 percent to compensate for reduced (d) dimension.

#### WHEELING/TENSILFORM/TENSILVENT/SPECIFICATIONS

#### STRUCTURAL SLABS

Scope-All concrete over (joists), (beams), (pipe tunnels) shall be placed on Wheeling Tensilform (50), (75), (125) or (200) as manufactured by Wheeling Corrugating Company, Wheeling. West Virginia.

Material —Tensilform (50), (75), (if Tensilform 125 or 200 is required, specify by number from Table 1) shall be formed from cold rolled steel leaving a minimum yield strength of see Table 1-pounds per square inch and a nominal flute of ..... Sheets shall be (uncoated). x (depth) (galvanized), have a section modulus of .... and moment of ..... (See table 1.) inertia of

Erection - Tensilform (50), (75), (125) or (200) shall be placed with edges up and flutes at right angles to supports. End laps shall always occur over supporting members. Minimum end lap is 2" for welded attachment and is equal to top chord of support for clip attachment. All sheets shall be lapped one-half flute at side laps. Sheets shall be attached to top chord of supports by plug welding through special washers, or by self-drilling or self-tapping screws. For pipe tunnels only, sheets shall be laid on top of wall with at least 2" bearing on each wall, with no positive attachment required.

Reinforcement — For all 31/2" or deeper slabs provide specified mesh and drape over Wheeling's high-chair washer on which a No. 2 or No. 3 rod should be laid to provide continuous supports for the mesh. The chair washer to be placed at center of supports so that pour will cover mesh by 34 " at supports. Mesh shall not be over 3/8" above form at mid span. For 2½" and 3" slabs place mesh at center of slab.

Concrete — To prevent concrete leakage at side laps, concrete should be placed in the opposite direction to which sheets were erected so that top sheet at lap receives placement of concrete first. Concrete should be mixed and placed in accordance with accepted general practice approved by the architect.

#### ROOF CONSTRUCTION

(form and fill)

Scope -Insulating concrete for roof deck fill shall be placed on Wheeling Tensilform (50), (75), (125) or (200) as manufactured by Wheeling Corrugating Company, Wheeling, West Virginia.

Material—Tensilform (50), (75), (125) or (200) shall be formed from cold rolled steel with a minimum yield strength Sheets shall be hot dip galvanized by Wheeling patented (Cook-Norteman) process and conform to ASTM A525-71 Class G 90. Base steel shall conform to ASTM A-446-69 Grade E. Note: Do not use uncoated sheets in roof with fill construction.

Erection-Place Tensilform (50), (75), (125) or (200) with edges up, flutes at right angles to supports. End laps shall always occur over supports. Minimum end lap is 2" for welded attachment. (Clipped attachment is recommended only over volatile storage.) Lap all sheets one-half flute at side laps. Attach sheets to top chord of supports by plug welding through special washers or self-drilling and/or self-tapping screws. Fasten each end lap in the trough of the flutes at each corner (through four thicknesses of metal) and at center of end lap. At sides and side-lap, fasten sheet at each intermediate support. (At architect's option Tensilform 50 on spans of 24" or less, may be fastened alternately to each intermediate support in staggered pattern so connections are not less than 60" on center.)

When delivered, the contractor responsible for this portion of work shall see that Tensilform is stored off the ground, that it is covered to protect material from the elements and that it is

sloped to permit drainage.

Vent Clips—After welding, if necessary, insert Wheeling Vent Clips at side lap of each sheet, locating one at mid-span between purlins up to 4' spans and two clips at third-points between purlins for spans over 4'. Wheeling Tensilform sheets are supplied with a built-in venting feature.

Reinforcement — Reinforcement is not required generally for fills over Wheeling Tensilform. However, the aggregate manufacturer's recommendations should govern.

Insulating Concrete — Specifications for placing and curing of insulating concrete should follow aggregate or foam manufacturer's recommendations.

Caution — Calcium chloride or admixtures containing chloride salts must not be used with Tensilform.

Traffic and Storage - Exercise care to control traffic and storage of materials on Tensilform before pouring slab. Excessive spans should be planked or otherwise protected against damage from workers walking on material, heavy construction traffic and storage.

Roofing — Roofing should be applied after all aggregate manufacturer's requirements for curing time and weather conditions have been met.

OTHER WHEELING BUILDING PRODUCTS.

Expanded Metal Gratings and Partitions, Decorative Mesh Metal Lath and Accessories Wheeling Steel Framing Systems SofTite®—Cop-R-Loy® Galvanized Steel Steel Pipe Steelcrete Bank Vault Reinforcing

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BOSTON, MASS. 01801 10 Wheeling Ave. (617) 935-5550

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NEW ORLEANS, LA. 70119 **Tulane Building** (504) 822-5460

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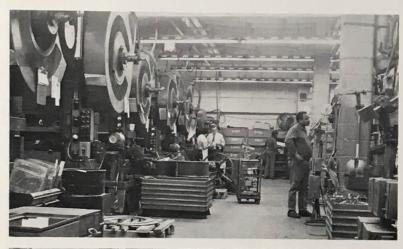
WHEELING, W. VA. 26003 1134 Market Street (304) 234-2346

\*Warehouse only

### Wheeling Corrugating Company

A DIVISION OF WHEELING-PITTSBURGH STEEL CORPORATION WHEELING, WEST VIRGINIA, 26003

## MAINTENANCE



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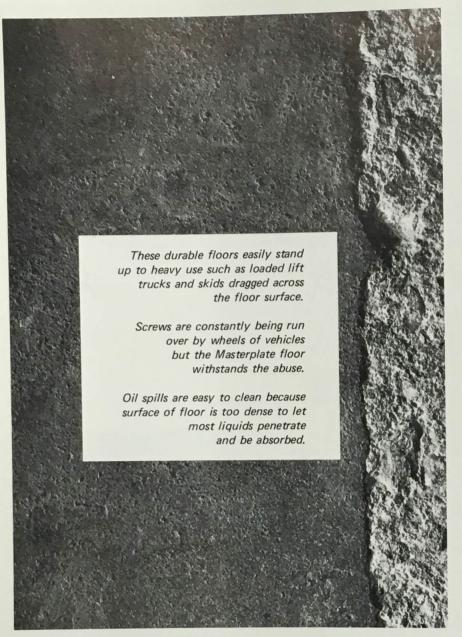




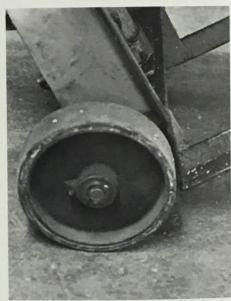
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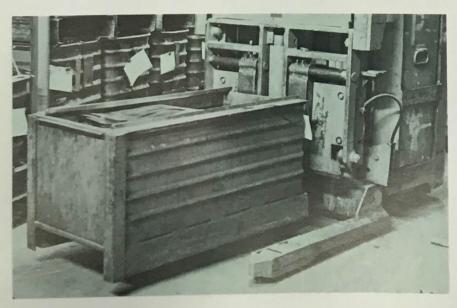
When a manufacturing company combined all its activities under one roof it was natural to install the same type of floor that had lasted in another facility for more than ten years under the most adverse conditions.

FLOORS WITHSTAND A DECADE OF ABUSE











Plant expansion and construction has been a way of life for Phil Rauch, Chairman of 59 year old Ideal Corp., in Brooklyn, N.Y. Mr. Rauch is a knowledgeable businessman and knows that growth in sales means plant expansions as well as profit growth.

He maintains this businessman approach in everything he does. His father had taken what started as a livery business and expanded it into a part-time manufacturing facility making hose clamps for the auto industry when he saw that his drivers had spare time between runs.

From these modest beginnings the company has undergone growth leading into many manufacturing areas. The original line of clamps now includes types suitable for the air conditioning, plumbing and OEM industries. Several years ago, auto flashers and tire hardware were added to the product lines.

When Mr. Rauch and his brother, Vice-President Lou Rauch, decided to move all of the Ideal activities into one large new plant, the choice of construction materials, particularly for the floors, was a prime concern. Manufacturing, warehousing and shipping facilities would all be contained in one 400,000 sq ft building, and each would impose a different type of challenge for any floor installed.

Since good businessmen learn by experience, past performance — not just price alone — influenced the choice of the floor material. For this reason, Masterplate was chosen over other types of flooring, including some costing appreciably less.

A rugged, durable floor is a must

for this type of operation: Each manufacturing process adds its own inherent problems to the conditions to which the floors are subjected daily.

For example, in the cutting department, automatic power presses weighing thousands of pounds exert punishing pressure over a relatively small area. Screws for the clamps, made in another part of the plant, occasionally end up under wheels of narrow-aisle lift trucks where they are literally ground into the floor surface, producing extreme point load forces. In assembly areas, the floor is under constant attack by moisture, while oil spills can occur throughout all the manufacturing areas in the plant.

Many floor surfaces can maintain their serviceability for just a few months under such punishment. At one particular Ideal plant, however, after a decade of three-shift, 24 hour per day operation, the floors are still in good condition. Ordinary concrete floors would have begun dusting and spalling long ago, but the surface here is in excellent shape. The use of Masterplate over ten years ago has proven to be a wise decision.

As many owners and plant engineers have discovered, the cost of low-priced floors can be very high indeed. Replacement of an unsatisfactory floor runs up to \$8.00 per square foot! And patching and retopping are also costly projects, amounting to as much as \$4.00 per square foot. Production loss during repair or replacement operations is also part of the cost of an inadequate floor surface. The obvious conclusion is that the economical

move is to put in a high quality floor to start with.

Specially prepared metallic aggregates, combined with exclusive water-reducing and plasticizing agents in Masterplate protect the brittle surface of the concrete slab underneath. The hard natural aggregates in ordinary concrete shatter and dust readily under traffic. Iron-armouring produces a surface up to four times as resistant to abrasion and impact as high-strength toppings and eight times greater than high quality plain concrete.

The malleable iron surface withstands impacts, eliminating problems of fracturing, crumbling, and dusting. The ultra-dense surface of this floor is 50 per cent less porous than plain concrete, so grease, oil and many industrial chemicals are not absorbed. They remain on the surface where they can be easily removed, greatly reducing maintenance costs.

When the floor was installed at the new plant, color, Terra Cotta, was chosen for a specific psychological reason. Past experience has shown that plantmen complained less of foot discomfort and worked more efficiently when the floor was given a colored surface.

This installation was a carefully considered step. As with previous expansion, construction was preplanned to the minutest detail. Past performance of the Masterplate floor during a decade of extremely hard use under adverse conditions was the best reason possible for the Rauch Brothers having that same iron-armoured surface installed at the new plant.



### It can cost \$5.00 per sq. ft. to correct a floor failure.

### MASTERPLATE prevents it for 25¢.

When the top 1/4" wears out, the entire investment in a concrete floor is lost, But that's not all.

A rough, disintegrating floor is a safety hazard. It creates contaminating dust. It can cause damage to equipment and production goods moved over it. It will cause production interference while the floor is being replaced.

So it pays to protect the surface of a concrete floor against disintegration. It also pays to be sure of the quality of protection you choose and use.

The more than one billion square feet of MASTER-PLATE iron-armoured floors that have been installed prove it produces industry's most wear-resistant, non-dusting

#### SOME PERTINENT FACTS ABOUT OUR PRODUCT

-MASTERPLATE iron-armours concrete with a ductile, impact-resistant surface. 28-day strength is over 12,000 p.s.i. Abrasion resistance is 4 to 8 times greater than the concrete or topping beneath it. Installed cost is only 20\* to 25\* per sq. ft. more than plain concrete.

#### A SIGNIFICANT FACT ABOUT OUR SERVICE-

When requested, a Master Builders field man will be on the job, during early stages, to explain application procedures under job conditions.

A REASSURING FACT ABOUT US—North America's leading manufacturer of products for improving concrete floors stands behind the performance capability of MASTERPLATE.

MASTERPLATE should be used when constructing new industrial floors or when resurfacing or replacing costly worn-out floors.

Like to know more? Call your local Master Builders field man, or write Master Builders, Cleveland, Ohio, 44118 and Toronto 15, Ontario.

MASTER BUILDERS

PERMIT NO. 614 Cleveland, Ohio

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MASTER BUILDERS
LEE AT MAYFIELD
CLEVELAND, OHIO 44118

#### Pattern for Performance

The wearing surface is the critical part of any industrial concrete floor. It takes all the abuse that a building full of workers and their equipment can produce.

This article reprinted from MODERN PLANT tells how past performance of one company's "iron-armoured" concrete floor established a pattern for their present floor selection.

or full data on quality floors, fill out this card	Please send information on Master Builders complete line of floor products.	Please have my local <i>Master Builders</i> field man call me to discuss our floor requirements.	0		pany	ressPhone	State Zip	
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iron-armoured floors are wear-resistant



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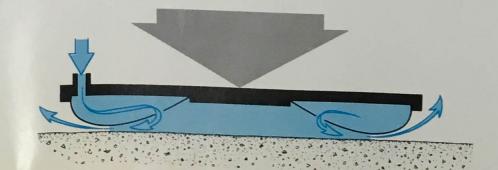
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## FOIGHT SYSTEMS



ON A THIN FILM OF AIR—TO DRASTICALLY REDUCE YOUR MATERIAL HANDLING COSTS.



## Two men can push 50 tons down this assembly line!

## Two men can push 50 tons down this assembly line!

Although the product on this line weighs 100,000 lb or more, two men can shove it from position to position, even leap-frogging one unit ahead of another. The key? The units move on air-film pallets.

Faced with the challenge of designing a production assembly line for the world's largest crawler tractor, Allis-Chalmers chose an air-pallet handling system, and saved thousands of dollars.

Allis-Chalmers, Springfield, Ill. selected air pallets as the building blocks for their giant, 100,000-lb-plus HD-41 tractor because they found moving heavy loads with air to be the most economical, most flexible, and most practical approach.

Their problem wasn't just one of weight. They wanted the flexibility to change the relative position of the tractors on the line, in effect, to "leap frog" one tractor around another. And they also wanted full accessibility to each tractor. This was necessary so that material could be brought quickly to the line, and workers could maneuver easily without being concerned with floor obstructions.

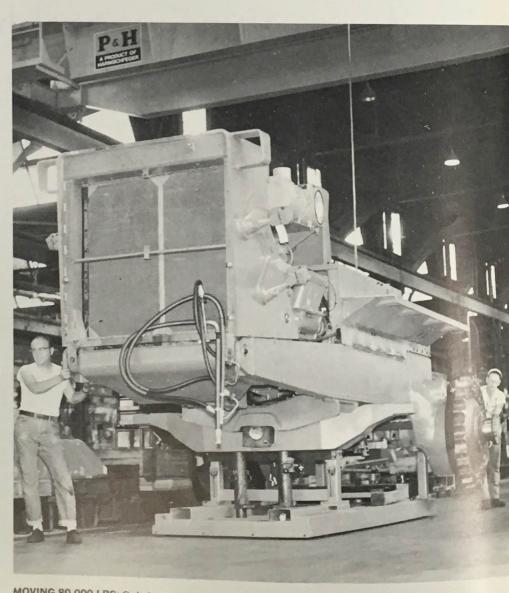
Neither a roller conveyor nor trackmounted transfer cars could provide the needed flexibility. Moreover, estimates showed the price of these alternatives to be at least three times the cost of the air pallet system. Overhead equipment also was considered. However, this too would have been more expensive than air pallets plus requiring strengthening of the building structure.

By using air pallets (Rolair Sys-

tems, Inc., and Sauk Valley Equipment Co.), flexibilty is built into the system. A pallet can be spotted anywhere within a large work area so that any partially-assembled tractor can be positioned ahead of another. Workers

also have full access to the tractors. And, all moves between work stations are made within minutes, by the workers themselves.

The system is a model of simplicity. The assembly line is nothing more

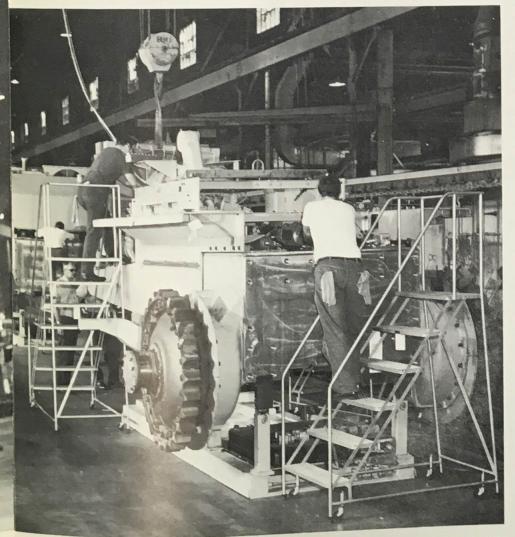


MOVING 80,000 LBS: Only two workers are needed to move this partially-completed tractor from one work position to another. Tractor can be manually positioned anywhere on the concrete slab which runs 325 ft down the assembly line.

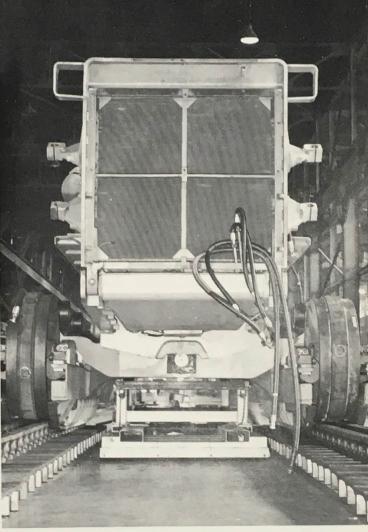
### How the air pallet works in large-product assembly



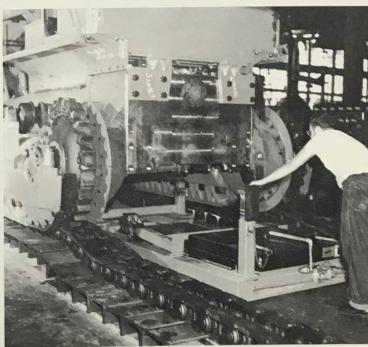
MAKING CONNECTION: Worker couples hose from pallet to air supply recessed in floor adjacent to assembly area. Thin film of air lifts the 3000-lb pallet and the tractor which it supports.



assembly area. Freedom from floor obstructions enable workers to when air lifting device (far left) is in upright position utilize wheeled ladders to gain full access to tractor.



NEARING COMPLETION: Crawler tread is laid out along floor before being attached to tractor. When assembled, tractor stands 14 ft high, weighs more than 50 tons.



BUILDING TRACTORS: Overhead crane brings components to the - REMOVING THE PALLET: Worker easily removes pallet

than a rectangular concrete slab, 325-ft long by 20-ft wide, with a smooth hard-steel-trowel finish.

Originally, when this portion of the plant was used for conventional assembly operations, the floor was wood block over a 9-in. thick concrete base. Allis-Chalmers merely removed the block and topped-off the existing base with 3 in. of concrete.

Recessed on the floor, along one long side of the concrete slab is an air line. Line pressure is 90 psi. Valve couplings, each with a hand-operated lever, are spaced every 25 ft. Hinged metal gratings cover the air supply and permit cross-over traffic.

Steel-framed air pallets are the conveying means.

Each one weighs about 3000 lbs and measures just over 8-ft long and 3 ft wide. Uprights at the four corners of each pallet support the full weight of the tractor. The base of each pallet is made up of several inter-connected air passages and several steel cross members (see drawing).

Ten separate 28-in. diameter air bearings form the lifting means. These are mounted in base of each pallet, between the steel members. An enclosed chamber mounted on one end of each pallet contains 50 ft of retractable hose with a quck-disconnect coupling at the end. When the hose is connected to the air supply, movement of the hand lever releases the flow of air to the pallet. The air first passes through a regulator where its pressure is reduced to 70 psi, then flows through the individual air

bearings. As the air escapes from the bearings it forms a thin film which lifts the pallet a fraction of an inch above the floor. Workers then manually push the pallets between stations.

When the air supply is cut off, the pallet settles slowly to the floor. The air hose then can be disconnected and coiled within the enclosed chamber so as to prevent a possible work hazard.

#### FLOATING THE LOAD

The assembly operation actually begins on a 175-ft-long section of track immediately preceding the air pallet area. There, drive assemblies are built on manually-propelled transfer carts.

First, the tractor's two planetary gears are aligned on a stationary fixture. A housing is then lifted into position by an overhead crane. After the housing has been connected to the axles, the unit is lifted onto a transfer cart. Small components are then added to the housing as the cart is moved to the end of the track. The sub-assembly and cart now weighs about 18,000 and requires all the muscle of two men to power it. At this point the subassembly is lifted by the overhead crane and positioned on one of the air pallets. Now one man can easily move the 9-ton load.

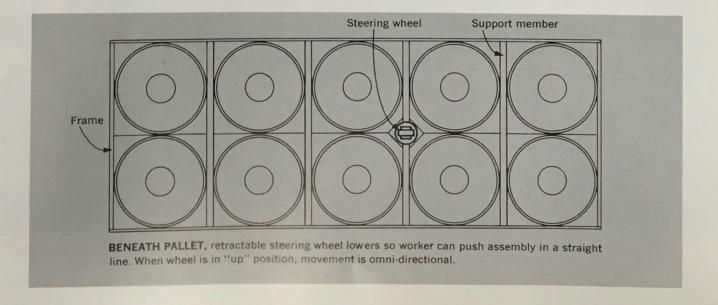
Components are brought to the air pallet line on flat-bed trucks and lifted by crane onto the pallets. Workers climb portable step ladders to perform the necessary welding and bolting operations. The same air source that supplies the pallets is used to power air-actuated assembly tools.

Between moves, the air supply is cut off and the pallet rests on the steel cross members; the air bearings do not support the pallet or load. Because there are no rails or tracks, the pallets can be positioned anywhere on the concrete floor. Thus, one tractor can easily by-pass another. It's just a matter of pushing one pallet to the side and moving another forward.

At the end of the line, the pallet is removed from the tractor by means of an air-powered lifting device. This is made up of three parallel lifting platforms, each about 2-ft wide by 14-ft long. Mounted on the undersurface of each platform are sixteen 10-in.diameter diaphrams. These are connected to a separate air source via a series of air valves.

The center platform and either outside platform can be raised or lowered simultaneously. When they're lowered the platforms are just about flush with the concrete slab.

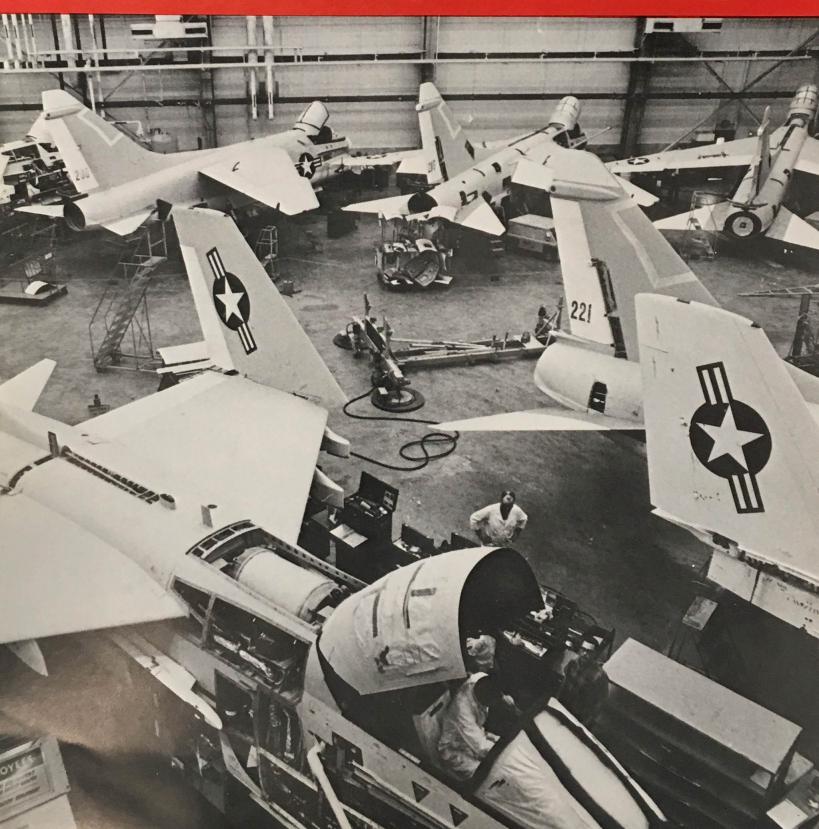
Before a tractor reaches the end of the line, its crawler treads are laid out on top of two of these platforms. The pallet is then pushed between the two platforms so that the tractor's wheels straddle the platforms. A worker then opens the air valves to lift the platforms and raise the treads so that they can be attached to the drive wheels. When this is done, the platforms are raised 6 inches and the pallet is removed.





## ompressed Air

A REVIEW OF THE CAPABILITIES AND ECONOMIES OF AIR AND GASES







**Tripod jacks** (left) were used to lift aircraft. Air bearings and special dollies (above) have replaced them; one set is shown ready for use.

**Air flotation system** allows pinpoint placement of twelve A-7E Corsair II light attack aircraft (far right) on hangar floor.

**Crew maneuvers aircraft** (below) into position for final outfitting. Plane is suspended by crane until air bearings can be slipped underneath.







#### THE BEST WAY

Air bearings solve compound problem of time and money



Finding the best way to get a job done quickly for the military is an old story at Vought Aeronautics Division of LTV Aerospace Corporation. In peak production during World War II, the company, then Chance-Vought, turned out 40 fighters a day. Now in its fifty-third year as an airplane manufacturer, the firm has a contract to deliver A-7D tactical fighters to the air force and A-7E's to the navy, the latter being the navy's newest light attack aircraft developed for precision air support of frontline troops and tactical zone bombing.

Shortly after Vought opened a new assembly hangar, one of 225 structures at the sprawling complex west of Dallas, Tex., an air flotation system was installed to allow quicker pinpoint placement of each plane for testing operational equipment. The system uses an air film and replaces hand-operated tripod-type jacks. It has provided not only a saving in time, but a safer environment for testing. Twelve Corsair II light attack aircraft can be closely positioned within the towering hangar.

Three air bearings, connected directly to a T-shaped dolly, make up the casters for each of six "sets" of bearings in use in the hangar. Their design is such that they easily handle the 19,000-pound aircraft (wing span, nearly 39 feet; length, 46 feet; height, 16 feet). On-off air valves for the bearings are operated quickly by a single employee. The bearings are equipped with their own stabilizing chamber, eliminating any throttling of incom-

ing air. Inlet air pressure is supplied at 75 psig from standard 1-inch plant lines.

The air bearings are specially compounded elastomeric diaphragms made by Rolair Systems, Inc., formerly Transocean Air Systems Corporation. They are inflated during operation. Friction is minimized; controlled leakage creates a layer of lubricating air between the bearing and the floor. Even though the diaphragms must resist abrasions or tears caused by screws, bolts, and bits of metal, they are essentially self-protecting. There is a 0.003-inch gap between the bearing surface and the floor, thus the diaphragms push foreign material out of the way. They can only be damaged by a sharp object imbedded in the floor. Without moving parts, maintenance is nil.

Usually three men hand-maneuver the dolly for directional accuracy, although one man can easily push the 9 tons of aircraft supported on the air film. In most instances, the flotation system is used in conjunction with a crane for fine positioning of the craft during outfitting and testing of gears, wheels, and other operational and emergency devices.

The aircraft enters the hangar after being X-rayed for any structural defects and is towed out to the production hangar for a final preflight clinic. Phil Spalding, manufacturing engineer, reports it is safer to have the A-7 on the dolly during the testing of operational equipment. It eliminates any chance the aircraft could jump the hand-operated jacks previously used.

# LOW PROFILE TURNITABLES

ro dir

CAPACITIES TO
140,000 POUNDS
SIMPLICITY OF DESIGN
OFF-CENTER LOADING
EASE OF INSTALLATION
RUGGED CONSTRUCTION
AIR OPERATED

**BULLETIN NO. 474** 



# rolair LOW PROFILE TI

Rolair turntables utilizing compliant air bearings provide a fast, economical, and accurate means of rotating heavy loads for a broad range of industrial purposes.

# **FEATURES**

Low Profile · Rolair Turntables are designed for the lowest economical profile - 3" to 4". Costly pit installation is not necessary.

High Capacity · Up to 70 tons for a 12 foot diameter table. Larger capacities available to meet special requirements. Air Operated · Floating on a frictionless, thin film of air supplied by any standard 90 P.S.I. shop air system, Rolair Turntables can be rotated by hand or by optional air powered drive unit(s).

Simplicity of Design . The free-floating load deck pivots on a rugged center line bearing and is easily removed for installation and inspection. Simply lift outno bolted connections. The use of air bearings and the lack of slip rings

eliminates wear problems. Because the load deck is free of stationary components, full rotation is permitted, and no wind up limitations exist.

Off Center Loading . As shown in the chart on opposite page a reasonable degree of off-center loading can be tolarated, depending upon model selected and load weight in relation to rated capacity.

Rugged Construction · Rugged, ribbed steel construction provides strength and stability to handle loads up to 140,000

Ease of Installation · Due to extremely low profile, Rolair Turntables may be mounted on top of existing floors; flush in woodblock floors; or in a shallow pit in concrete floors. Simple installation consists of a few anchor bolts and standard air hook up.

# OPTIONAL ACCESSORIES

Drive Unit (TCD-100) · This air-driven prime mover will rotate loads in either direction at walking speed.

# Rotational stops

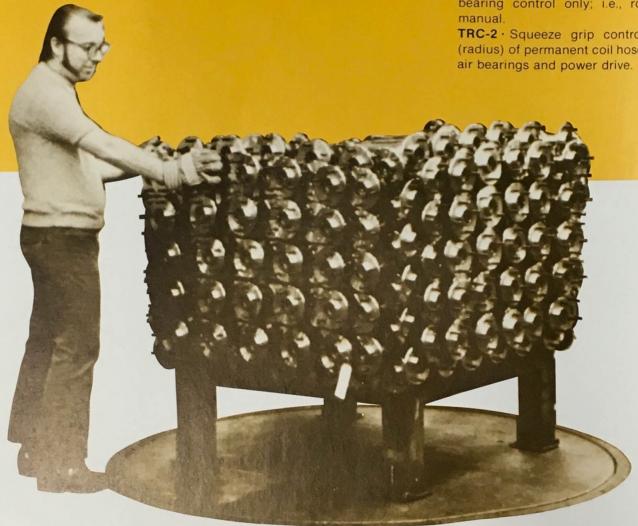
TCS-1 · Permits fixed amount of rotation in either direction. State desired arc in degrees when ordering. (Internally mounted.)

TRS-1 · Permits interrupted continuous rotation in either direction. State desired arc(s) in degrees when ordering. Externally mounted above grade on control box lid

Remote Control · Unless one of the following remote controls is specified. the turntable will be equipped with local control installed in the non-rotating control box mounted to turntable wall.

TRC-1 · Squeeze grip control on 15' (radius) of permanent coil hose for air bearing control only; i.e., rotation is

TRC-2 · Squeeze grip control on 15' (radius) of permanent coil hose for both

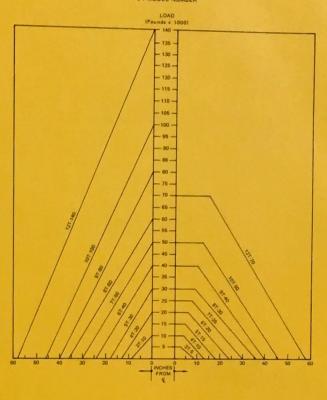


# BNTABLES

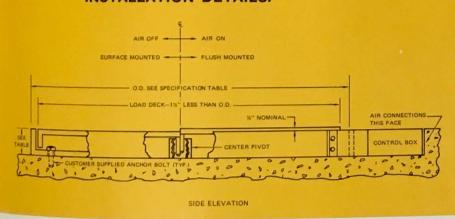
# ROLAIR TURNTABLE SPECIFICATIONS

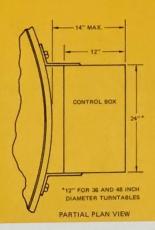
Outside			Nominal* Height (Inches)		Peripheral Drive Force	Number of Drives Required	Air Consumption (S.C.F.M.)	
Diameter (Inches)	Model Number	(Pounds)	Air Off	Air On	Required (Pounds)	(Non-Manual Operation)	With- out Drive	With
36 36 48 48 60 60 72 72 72 84 84 96 96 108	3T-5 3T-10 4T-10 4T-20 5T-15 5T-30 6T-20 6T-40 7T-25 7T-50 8T-30 8T-60 9T-40 9T-80	5,000 10,000 10,000 20,000 15,000 30,000 20,000 40,000 50,000 30,000 60,000 40,000 80,000	3½ 4 3½ 4 3½ 4 3½ 4 3½ 4 3½ 4 3½ 4 3½ 4	4 4½ 4 4½ 4 4½ 4 4½ 4 4½ 4 4½ 4	5 10 11 23 19 37 28 55 36 72 46 91 60 118	- - 1 1 1 1 1 2 1 2 2 2	10 20 15 30 20 40 25 50 30 60 35 70 40 80	Drive
120 120	10T-50 10T-100	50,000 100,000	31/2	4 41/2	77 154	2	50 100	110 190
144 144	12T-70 12T-140	70,000 140,000	3½ 4	4 41/2	104 208	2 4	65 130	125 250





# **INSTALLATION DETAILS:**





# ON A THIN FILM OF AIR — TO DRASTICALLY REDUCE PROFILE AND YOUR MATERIAL HANDLING COSTS.

The lubricating effect of a thin film of air eliminates all the problems of friction. With ROLAIR equipment you can move, rotate, and precisely position any load no matter how big or heavy at a major savings over other material handling methods.

This catalog gives the specifications of standard ROLAIR turntables incorporating ROLAIR'S patented air bearings.



ROLAIR frictionless movement is based on our patented compliant air bearings formulated of a specially-compounded elastomeric designed for long life under rugged industrial conditions. They are the result of a decade of experience in air film technology and material handling by ROLAIR'S technical staff. For our guarantee of performance, see back page.







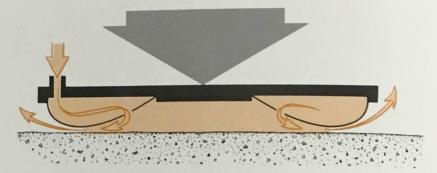
MODERN MATERIAL HANDLING EQUIPMENT

# TO COURT EQUIPMENT FLOATS EVEN THE HEAVIEST LOADS ON A THIN FILM OF AIR—TO DRASTICALLY REDUCE YOUR MATERIAL HANDLING COSTS.

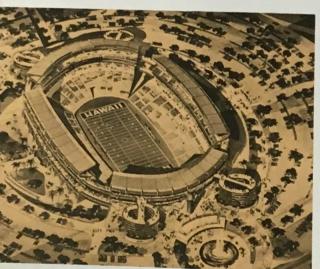
The lubricating effect of a thin film of air eliminates all the problems of friction, so one man can move what would ordinarily be hard work for many men or costly equipment.

With ROLAIR equipment you can lift, carry, and precisely position any load no matter how big or heavy at a major savings over other material handling methods.

This catalog gives the specifications of standard ROLAIR equipment. Our capability is actually much larger because if standard equipment won't do, we'll design to your specific application. Just give us your requirements and we'll give you a ROLAIR product with maximum life and performance.



ROLAIR frictionless movement is based on our patented compliant air bearings formulated of a specially-compounded elastomeric designed for long life under rugged industrial conditions. They are the result of a decade of experience in air film technology and material handling by ROLAIR's technical staff. For our guarantee of performance, see back page.











\*COPYRIGHT 1973, ROLAIR SYSTEMS, INC.

# Each item listed has these advantages:

Ease of Movement — Material and equipment can be moved omnidirectionally with minimum effort anywhere in your plant. One man can push 50,000 to over 100,000 pounds. Heavier items can be moved by equipment of unbelievably low draw bar pull — 1 or 2 pounds per 1000 pounds of load.

Precision Placement — Loads of any size can be turned on their own axis and positioned within a small fraction of an inch.

Minimum Cost — Many ROLAIR customers have saved more than 50 percent over other material handling equipment.

**Minimum Maintenance** — Since there are no moving parts (a few optional accessories excepted), maintenance requirements are minimized.

**Air Operated** — Utilizes existing shop air supply unless otherwise specified for silent, clean operation.

Low Floor Loading — Normally 10 psi or less: the lowest of any type of material handling system. It's possible to move hundreds of tons, without floor wear or damage. Shock and Vibration Isolation — Even the most delicate equipment is fully protected from damage when it floats on air. Gentle, cushioned movement at all times.

Low Operating Pressure — ROLAIR's low operating pressure range, normally 10 psi or less, has been chosen for optimum economy of air usage and maximum compatibility with floor surface.

Better Load Access — Thanks to the equipment's low profile.

Long Life — Each item of equipment is quality engineered for *rugged*, dependable long life under heavy-duty industrial usage. See our guarantee on the back page.

Safety — Positive load control at all times — Skilled operators are not required. Since a load is just barely lifted, release of air pressure gently and instantly settles the heaviest load to the floor where it remains in positive non-slide contact. And ROLAIR equipment is safe in hazardous atmospheres.

Stability — Each of the ROLAIR products contained in this brochure has a stabilizing system that enables it to function over a broad range of conditions without operator adjustment.

**Proven Dependability** — A decade of experience in air film technology and modern material handling lies behind all ROLAIR products. Many applications have been in service for years without the need for *any* replacement parts.

On the following pages you'll find a number of different ways to handle material on ROLAIR equipment. Each is designed to solve a specific material handling problem.







ROLAIR Standard Transporters make handling loads of one ton or hundreds of tons easy. Whether you choose Transporters of steel or plywood construction, each four-airbearing unit offers an unobstructed, low profile, loading surface for precision movement of equipment and material with minimum effort. Just attach to standard shop air and with every pound or two of push or pull you can move a thousand pounds of load.

As you can see, ROLAIR offers a wide variety of standard air film Transporters and accessories. If you don't see just what you want, chances are we've designed it for someone else and would be happy to offer it to you.

# **FEATURES**

**Low Pressure Operation** — Floor and operating pressure will normally be 10 psi or less for minimum air consumption and maximum compatibility with floor surface.

Off-Center Loading — ROLAIR's special air distribution system permits each air bearing to function independently of the others allowing a wide degree of off-center loading. Air Flow Control — For optimum performance and minimum air consumption, all transporters come complete with controllable air inlet valves that permit air flow adjustment to size of load and floor surface condition. In addition, type R4 and B6 Transporters are equipped with adjustable orifices at each of the four air bearings, permitting flow adjustment for severe load imbalance and surface condition.

**Module Use** — ROLAIR Transporters, when used in combination, can provide literally infinite load capacity.

Fast Maintenance — ROLAIR bearings on type R4 and B6 Transporters can easily be removed for inspection, maintenance or replacement in seconds while the Transporter is fully loaded. Maintenance on types P1 and R3 is simple but load must first be removed.

Omnidirectional Movement — No wheels, no tracks make movement in any direction possible and simple.

**Shop Air Operation** — All Standard Transporters are designed for ordinary shop air operation.

Forklift Slots — All steel Transporters come equipped with forklift slots for ease of handling.

Broad Range of Sizes - See Table





REMOTE CONTROL

# OPTIONAL ACCESSORIES

### Handle Bar

Available for all types. Type R4 shown.

### **Transit Wheels**

Transit wheels in sets of four allow easy handling of unloaded Transporter when use of shop air is inconvenient. Available for types R4 and B6. Type R4 shown.

### Tow Bar

Available for types R4 and B6. Type R4 shown.

## **Guide Wheel**

Designed to provide maximum precision of movement, wheel when actuated, makes contact with the floor providing precise directional control. It also serves as a pivot point for on-axis turns. Available for types R4 and R6.

### **Remote Control**

Designed for positive load control, unit includes fast-exhaust dump valve and squeeze-grip control on 25' of permanent coil hose. Release of squeeze-grip valve instantly stops transporter. Extra remote stations as required. Available for types R3, R4, and B6.

# **Drive Unit**

This powerful, air-driven, prime-mover will drive loads in forward or reverse at walk-

ing speed. Available for type B6, unit consists of air motor, gear reducer, chain drive and dual pneumatic tires. Normally counterbalanced in the up position, wheels also act as pivot point for on-axis turns when actuated. Control choices available are: simple manual, stationary handle (see below) or flexible remote. Please specify.

## **Fixed Control Handle**

Drive unit control includes starting torque boost valve; forward, reverse, and neutral shift lever; and speed control. Also squeezegrip deadman control for air bearings. Single air feed to both drive and air bearings. Built-in air filter and lubrication provided for air motor. Available for type B6. For simple manual or flexible remote control, contact factory.

### Hose Reels

Retractable hose reels available for floor, wall, ceiling or Transporter mounting. Specify length of hose desired.

# Superstructures

Load support superstructures designed and furnished to your load requirements on a custom basis.

## **Skid Adapters**

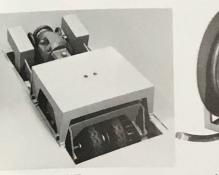
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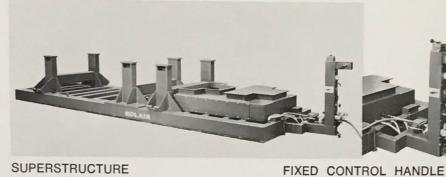
Type B6 - ALL-WELDED RIGID STRUCTURAL STEEL FRAME WITH PLATE SKINS.



20 CAPACITIES TO 240,000 POUNDS







DRIVE UNIT

HOSE REEL

SUPERSTRUCTURE

# ROLAIR STANDARD TRANSPORTER SPECIFICATIONS

Capacity	(lbs)				Dimen	sions	(inch	nes)	
				He	eight	Wid	lth**	Len	gth**
Standard Duty	Heavy Duty*	Туре	Model No.**	Air- Off	Air- On*** (Nom)	Min.	Max.	Min.	Max.
2,000 4,000 6,000 8,000 10,000 16,000 24,000 24,000 40,000 40,000 56,000 70,000	4,000 8,000 12,000 16,000 20,000 32,000 32,000 48,000 80,000 80,000 112,000 140,000	P1 P1 P1 P1 R3 R3 R3 R4 R4 B6 R4 B6 R4	2P1-2626 4P1-3434 6P1-3838 8P1-4848 8R3-3636 10R3-4040 16R3-4848 16R4-5048 24R4-6258 24B6-5861 40R4-7470 40B6-7073 56R4-8682 56B6-8286 70R4-9490	3 3 3 3 3 <sup>1</sup> / <sub>2</sub> 3 <sup>1</sup> / <sub>2</sub> 4 <sup>5</sup> / <sub>8</sub> 4 <sup>3</sup> / <sub>4</sub> 7 <sup>1</sup> / <sub>4</sub> 4 <sup>3</sup> / <sub>4</sub> 7 <sup>1</sup> / <sub>4</sub> 5	33/8 31/2 35/8 33/4 4 41/8 41/8 41/8 53/8 53/4 6 81/2 61/4 83/4	26 34 38 48 36 40 48 50 62 58 74 70 86 82 94 90	48 48 48 48 52 60 60 72 72 82 82 94 94 94	26 34 38 48 36 40 48 48 58 61 70 73 82 86 90 94	96 96 96 96 96 96 96 120 120 120 120 150 150
120,000 120,000	140,000 240,000 240,000	B6 R4 B6	70B6-9094 120R4-96140 120B6-96144	7½ 5 7½	91/ <sub>4</sub> 7 91/ <sub>2</sub>	96 96	96 120	140 144	180 180

Air Inlet Thread — Type P1 and R3 —  $\frac{1}{2}$ " FNPT Type R4 and B6 — 1" FNPT

- \* STANDARD DUTY supplied unless HEAVY DUTY specified. HEAVY DUTY capacity Transporters operate at twice the bearing or floor pressure of standard duty transporters and will require better floor surfaces for optimum performance. For optimum performance, load on P1 type HEAVY DUTY Transporters should be spread uniformly.
- \*\* When ordering specify size wanted by last four digits of Model No. Example: 8R3-3640 is an 8000# capacity steel Transporter 36" wide by 40" long. Within limits of minimums and maximums shown, width and length dimensions may vary by 2" increments for P1 & R3 Series, 4" increments for R4 & B6...

\*\*\* - 75% of Lift (Air On-Off) for Heavy Duty Types.





Type R3 and R4 — ALL-WELDED HEAVY WALL STRUCTURAL STEEL TUBING.



Type P1 - SOLID CORE METAL SURFACED WEATHERPROOF PLYWOOD.

ROLAIR ST bearings are made with heavyduty, structural backplates to accept concentrated loading directly. They are widely used in modular home construction, assembly line movement of machine tools, engines, aircraft, missiles, giant electrical transformers and generators, and even to move bleachers and grandstands. Inserted under storage racks, they double the amount of storage space in a given area by eliminating the necessity for all but one aisle. As a rigging tool they are indispensable. In combination they can be used to move just about any size load. When movement of large structures is a problem, ROLAIR ST bearings can usually provide greater ease of movement at a fraction of the cost. Three or more ST bearings under a rigid load is in essence a transporter relying on the structural integrity of the bottom surface of the load. If such point loading is not feasible, a ROLAIR Transporter is appropriate.

## **FEATURES**

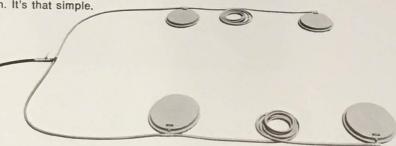
Simple Installation—ROLAIR ST bearings need not necessarily be attached to the load. Simply insert under the load at appropriate load bearing points and connect through a manifold to your shop air supply. Air Flow Control—For optimum performance and maximum air economy each ST bearing is equipped with a controllable air inlet valve that permits air flow adjustment to severe load imbalance and floor surface conditions.

Air Manifold—On request, ROLAIR will furnish as optional equipment an air manifold consisting of a manual on-off valve and hose and fittings. Please specify anticipated distance between bearing locations.

Operation—Is safe and easy. Just turn on the air and push. It's that simple.



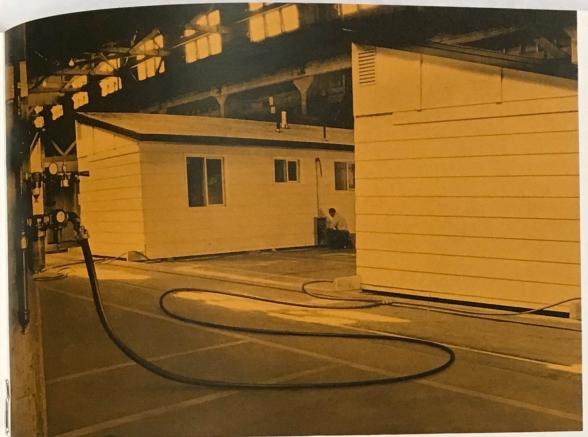


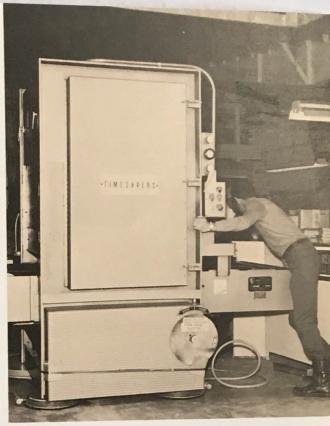




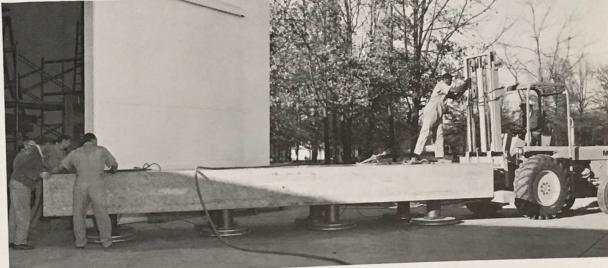
# rolair ST BEARINGS

15 CAPACITIES TO 60,000 POUNDS









# ROLAIR ST BEARING SPECIFICATIONS

Capacit	Capacity (lbs)		Di	mensio	nsions (inches)		
				Height			
Stan- dard Duty	Heavy Duty(1)	Model Number (1)	O.D.	Air-Off	Air- On* (Nom)	Mtg. Hole Bolt Circle(2)	
1,000 2,000 2,500 4,000 6,000 10,000 14,000 18,000 30,000	8,000 12,000 20,000 28,000 36,000 60,000	34ST 40ST 44ST	12 16 18 22 28 34 40 44 48x70	21/2 21/2 21/2 21/2 21/2 35/8 35/8 37/8 37/8	2 <sup>7</sup> / <sub>8</sub> 3 3 <sup>1</sup> / <sub>8</sub> 3 <sup>1</sup> / <sub>4</sub> 4 <sup>5</sup> / <sub>8</sub> 4 <sup>7</sup> / <sub>8</sub> 5 <sup>1</sup> / <sub>8</sub> 5 <sup>1</sup> / <sub>4</sub> 5 <sup>3</sup> / <sub>8</sub>	6 6 6 8 10 13½ 13½ 36	

(1)—Standard supplied unless Heavy Duty specified.
(2)—For Heavy Duty applications spread load over 50% of interface.

\* -75% of Lift (Air On-Air Off) for Heavy Duty Types.

+	OUTSIDE DIAMETER  4 MOUNTING HOLES %"-167	<del>-</del>
AIR ON HEIGHT	1/2" FNPT	AIR OFF HEIGHT
	AIR OFF— LOAD SUPPORT	

ROLAIR's combination of an air bearing and a vertical lift jack lets you quickly change hard-to-move heavy plant equipment into completely mobile units regardless of size or weight.

Whether permanently installed or temporarily used for plant rearrangement, or material transfer, ROLAIR SJ bearings provide a maximum of flexibility in effortless omnidirectional movement, alignment, and vertical adjustment.



# **FEATURES**

Picks up Load – Easy to attach bolt-on side mounting brackets make getting under the load unnecessary. Readily attachable to existing structures.

Air Flow Control—For optimum performance and maximum air economy ROLAIR SJ bearings are equipped with a controllable air inlet valve that permits air flow adjustment to severe load imbalance and floor surface condition.

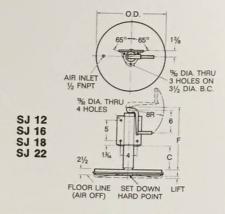
Low Pressure Operation—Floor and operating pressure will normally be 10 psi or less for minimum air consumption and maximum compatibility with floor condition.

Ease of Installation—Simply adjust height of jacks to structure attachment points and bolt on. Three or more should be used for balance and located so that each carries approximately the same weight. Connect to your shop air supply through an appropriately sized manifold.

Air Manifold—On request ROLAIR will furnish as optional equipment an air manifold consisting of a manual control valve, hose and fittings. Please specify distance anticipated between bearing locations.







# ROLAIR SJ BEARING SPECIFICATIONS

Capacity (lbs)			Dimensions (Inches)						
Load	Crank*	Model No.	Jack Stroke	O.D.	F (Retracted)	C (Retracted)	Lift		
1,000	1,000	SJ12-5 -10 -15	5 10 14½	12	12 17 23½	1/ <sub>2</sub> 51/ <sub>2</sub> 12	3/8		
2,000	2,000	SJ16-5 -10 -15	5 10 14½	16	12 17 23½	1/ <sub>2</sub> 51/ <sub>2</sub> 12	1/2		
2,500	2,000	SJ18-5 -10 -15	5 10 14½	18	12 17 23½	1/ <sub>2</sub> 51/ <sub>2</sub> 12	5/8		
4,000	2,000	SJ22-5 -10 -15	5 10 14½	22	12 17 23½	1/ <sub>2</sub> 51/ <sub>2</sub> 12	3/4		

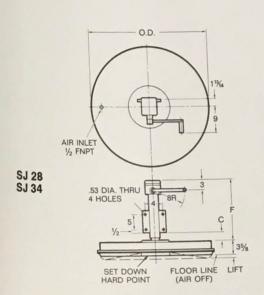
# rolair SJ BEARINGS



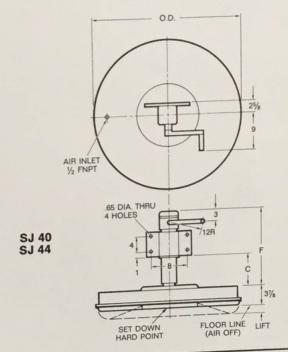








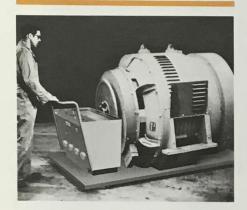
Capacit	Capacity (lbs)		Dimensions (Inches)					
Load	Crank*	Model No.	Jack Stroke	O.D.	F (Retracted)	C (Retracted)	Lift	
6,000	5,000	SJ28-6 -12 -18	6 12 18	28	18 24 30	3 3 3	1	
10,000	7,500	SJ34-6 -12 -18	6 12 18	34	18 24 30	3 3 3	11/4	



0 - 14	Capacity (lbs)		Dimensions (Inches)						
	Crank*	Model No.	Jack Stroke	O.D.	F (Retracted)	C (Retracted)	Lift		
Load 14,000	10,000	SJ40-6 -12 -18	6 12 18	40	19 25 31	8½ 8½ to 14½ 8½ to 20½	11/4		
18,000	10,000	SJ44-6 -12 -18	6 12 18	44	19 25 31	8½ 8½ to 14½ 8½ to 20½	13/8		

<sup>\* —</sup> Cranking at Load Capacity Permissible for Intermittent Adjustment.

ROLAIR Electric Transporters offer maximum load capacity at minimum capital investment. Loads to 16,000 pounds easily handled by one man without drive units or shop air. The battery-operated built-in air supply makes them particularly suitable for precision movement of medium and heavy loads over long distances or where shop air is unavailable or inconvenient. Designed for years of rugged, reliable service.



# FEATURES Type ETF

On Board Air Supply-Four unitized, longlife, 110V AC/DC air-cooled motor/blower packages, one for each ROLAIR bearing, provide large air volume for maximum load capability in ultra low pressure range (2 psi). Battery Operated - The model ETF Electric Transporter uses ten 12V heavy-duty commercial batteries, type 27F (not supplied by ROLAIR). Full shift operation-three hours continuous duty at full load. Automatic recharger built-in with overcharge cut-off protection.

110V AC Operation - Also can be operated off house current. Simply plug in and throw selector switch.

Lowest Operating Pressure - A maximum of 2 psi operating and floor pressure at rated

# FEATURES Type ETP

Own Air Supply-Four, high capacity, rugged air pumps powered by 24 volt D.C. motors provide each ROLAIR bearing with sufficient volume of air to operate at 10 psi for heavy load capacity.

Battery Operated-The ETP unit uses one 24 volt standard industrial battery, Type HYL-13 (not supplied by ROLAIR). Full shift operation.

Optional 220V AC Operation - The ETP unit is also available wired for 220 volt A.C. facility current operation rather than by batteries. This version is particularly suitable for shuttle type operation within confined areas.

# FEATURES COMMON TO BOTH

Off-Center Loading-Since each air bearing functions completely independently of the others a wide degree of off-center loading is possible.

Guide Wheel-Designed to provide maximum precision of movement, wheel when actuated from control panel, makes contact with the floor providing precise, directional control. It also serves as a pivot point for on-axis turns.

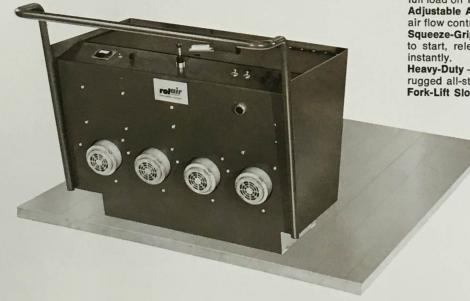
Bearing Replacement-This very special ROLAIR design feature permits air bearing replacement in just a few minutes even with full load on Transporter.

Adjustable Air Flow-Load-on and load-off air flow control from panel.

Squeeze-Grip Control - Squeeze handle bar to start, release to stop. Starts and stops

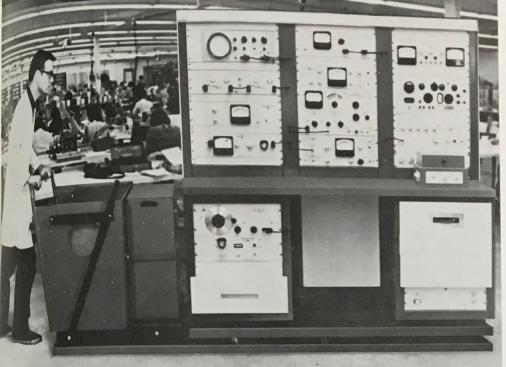
Heavy-Duty - Console and platform are of rugged all-steel welded construction.

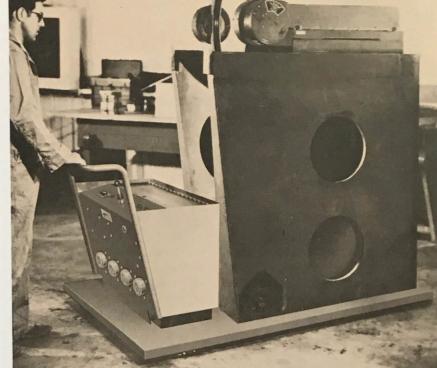
Fork-Lift Slots - Built-in.



# rolair ELECTRIC TRANSPORTERS

Type ETF and ETP 6 CAPACITIES TO 16,000 POUNDS





# SIMPLIFIED CONTROLS



OPERATION - is simple, safe, and easy. Squeeze handle and push.

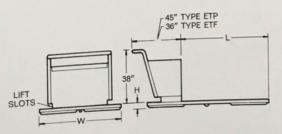
# OPTIONAL ACCESSORIES FOR BOTH

Skid Adapter—Permits easy handling of skid loads. Fly transporter under loaded skid with mechanical skid adapter in down position. Release air from bearings, then turn skid adapter up. When air is turned back on, the loaded skid is completely mobile. Superstructure — Custom load supports to your specifications.

# SPECIFICATIONS FOR ROLAIR ELECTRIC TRANSPORTERS

				Dimensions (inches)						
Load			F	1		L				
Capacity (pounds)	Туре	Model No. (1)	Air-off	Air-on (Nom.)	W	(1) min.	max.			
1,500 2,500 4,000 6,000 10,000 16,000	ETF ETF ETP ETP ETP	1ETF-4040 2ETF-4848 4ETF-6258 6ETP-4040 10ETP-4848 16ETP-6258	2 <sup>3</sup> / <sub>4</sub> 2 <sup>3</sup> / <sub>4</sub> 3 <sup>3</sup> / <sub>4</sub> 2 <sup>3</sup> / <sub>4</sub> 2 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>4</sub> 4 5 <sup>1</sup> / <sub>4</sub> 3 <sup>1</sup> / <sub>4</sub> 3 <sup>1</sup> / <sub>2</sub> 4 <sup>3</sup> / <sub>4</sub>	40 48 62 40 48 62	40 48 58 40 48 58	72 84 96 72 84 96			

(1) When ordering, specify load-bed length wanted by last two digits of Model No. Example: 4ETF-6280 is a 4000# capacity type ETF unit with a load-bed length of 80 inches.



# Specifications common to all ROLAIR Equipment

# AIR SUPPLY

You can get optimum life and performance from ROLAIR air film products by giving them air from a minimum 90 psi source (Electric Transporters excepted), Special filtering is not required. The air distribution system should be such that this pressure does not drop below 80 psi when the air film equipment is in use.

The amount of air required is shown in the following chart as a function of load and floor surface. Except for very heavy loads and/or poor floor surfaces, the air consumption of ROLAIR products is quite like that of air tools, except our total air consumption is apt to be much less because of its short duty cycle.

### ENVIRONMENT

Standard industrial. ROLAIR bearings are equipped with specially compounded elastomeric diaphragms for unexcelled resistance to wear, abrasion, and most industrial chemicals.

### MAINTENANCE

ROLAIR equipment requires virtually no maintenance since the control valves, of non-corrosive materials, are in most cases the only moving parts. The bearings are easily repairable and replaceable. Historically, units have shown no measurable wear or material degradation after years of service.

## LOADING

The center of gravity of the load may be off center to the point where any one bearing is carrying 40% of the total load. *HEAVY DUTY* Transporters 30%.

# GUARANTEE

We guarantee for a period of twelve months after date of shipment all equipment manufactured by us, which maintained and operated in accordance with normal and proper use, to be free from defects in material and workmanship and that, if the equipment or any part thereof is returned to us, transportation charges prepaid, within twelve (12) months from date of shipment, and if our examination discloses to our satisfaction that the said equipment or part has been defective in workmanship or material, we will deliver to the purchaser without charge, f.o.b. our factory, parts of first class workmanship and material in exchange for any parts so found to be defective, and our obligation is limited to said exchange.

This guarantee is in lieu of all other guarantees, expressed or implied.

"All Specifications Subject to Change Without Notice"

# YOUR REPRESENTATIVE:

# FLOOR SURFACE

General—Many surfaces are suitable for ROLAIR operation. Particularly satisfactory is the modern factory or warehouse floor—smooth, sealed, steel-troweled concrete. For optimum performance the following specifications are recommended. If they are followed, ROLAIR equipment will provide years of satisfactory performance with a minimum of maintenance.\*

Surface Porosity—Since air film equipment requires a reacting surface, the floor surface should be non-porous. It should be sealed with a standard commercial penetrating sealer and should be free of grates, track-ways, trenches, or other such openings unless covered with a non-porous material such as sheet metal. Cracks and expansion joints should be filled. This may be quite easily done with commercial fillers such as coal tar based epoxy which can be applied by hand in just a few minutes.

Surface Texture—For best performance, surface texture should be comparable to that of steel-troweled concrete. Other surfaces can be upgraded through the use of epoxy-based coatings.

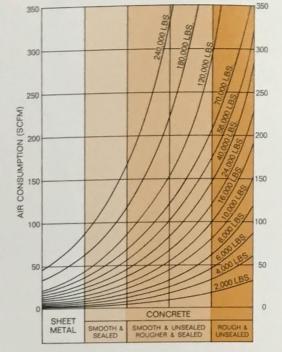
Surface Cleanliness — ROLAIR bearings are inherently self-cleaning. Loose material such as dirt, chips, drill rods, etc. will be pushed ahead or aside; occasionally some will be swallowed and ejected. For minimum maintenance, however, broom clean surfaces are suggested.

Surface Irregularities—In general the smoother the floor, the better the performance.

Obstacles—Projections up to ½" above the floor surface in local areas can be tolerated depending upon the size air bearings utilized. Where projection removal is impractical, it should be faired into the surrounding surface with suitable material such that the resulting ramp angle is 10 percent or less. If you have obstacles in your floor surface, it is suggested you contact ROLAIR.

Step Increase in Plane—Steps of 1/6th inch or less may be disregarded. Steps up to 1/2" or more may be traversed depending upon the size air bearings used and provided sufficient air flow is available; however, it is recommended that such a step be faired to 50 percent. If your floor surface has steps, it is suggested you contact ROLAIR.

Ramp Change in Plane—Since air bearings must remain essentially parallel to the floor, the transition from a ramp to a horizontal floor must be gradual. In the transition area, it should be limited to a 5 percent slope.



# U.S. PATENT NUMBERS

3,096,728	3,161,247	3,164,103	3,174,809	3,243,004
3,245,487	3,246,712	3,251,430	3,251,431	3,251,432
3,253,667	3,260,322	3,260,354	3,261,177	3,276,222
3,282,360	3,282,361	3,313,367	3,318,406	3,321,038
3,357,511	3,359,645	3,373,838	3,400,780	3,413,041
3 470 827	3 511 330			

# FOREIGN PATENT NUMBERS

Canadian	833,969	843,252	843,251	848,974
	805,004	781,313	712,020	828,845
	787,074	836,382		
Great Brit	Great Britain		1,075,529	924,834
	1,120,855			
Australia	248,664			
France	1,278,912			
Germany	1,152,891			
Japan	437,177			
Italy	642,682			

Other Patents Pending

195.281

Sweden



P.O. BOX 30363 SANTA BARBARA, CALIFORNIA 93105 PHONE (805) 968-1536 TELEX 65-8433 CABLE: ROLAIRSYS



<sup>\*</sup>Consult factory for floor specifications for heavy duty equipment.



**BULLETIN NO. 1072** 

# TO CIT SYSTEMS





Cover: Rolair is the primary material handling system in this transformer manufacturing plant. Transformers weighing up to 100 tons, cores, coils, core and coil assemblies, and core assembly fixtures are moved on Rolair equipment designed specifically to meet the customers' exacting assembly line requirements.

With Rolair equipment, you can lift, carry, and precisely position "any" load regardless of size and weight. But Rolair air film material handling systems do more than just move material. They can lower your capital investment by up to 80%. And while material is in motion, the system can cut operating costs and improve production output. On the following pages, you'll find how Rolair achieves these ends, throughout a broad spectrum of industry.

# A **rolair** SYSTEM WILL LOWER INVESTMENT AND OPERATING COSTS AS YOU MOVE AND PRECISELY POSITION EVEN THE HEAVIEST LOAD.



**Top left:** Transformer core and assembly fixture are floated into a very precise, keyed position in the floor of the crane bay. **Bottom left** — Entire fixture is upended. **Above** — Core is floated away.

Because Rolair systems literally float "any" load over your floor, our engineers can furnish a system designed to lift, carry and precisely position the material you need moved, regardless of weight, size or form. You move it with minimum effort and maximum care, no matter what your requirements for precision, distance, speed or frequency. This is our only business: adapting the air film process to your task, in your environment. Even when thousands of tons must be moved. Whatever your material handling problem, our engineers have a wealth of experience to draw on. For systems using on-board or factory air, hand power or traction . . . Rolair's depth of engineering experience and more than 1000 installations has made the company the undisputed leader in the air film field.

# **POLICIE** SYSTEMS CAN BE DESIGNED AND BUILT TO FIT YOUR OPERATIONAL REQUIREMENTS.



As assembly starts, overhead crane lowers final drive and transmission on to a Rolair Transporter.



Main frame has been added. Two workers can easily push down-line at any stage.



Tractor begins to take final shape as components are added from lateral feeder lines, storage points and overhead crane.

Nearing completion, crawler tread is laid out along floor before being attached to tractor (after tractor is floated into position). When fully assembled, tractor stands 14 ft. high, weighs more than 50 tons.







Moving 40 tons: Only two workers are required to move this partially completed tractor from one work position to another. Tractor can be manually positioned anywhere on the concrete slab or moved by low drawbar-pull Rolair Traction Drive.

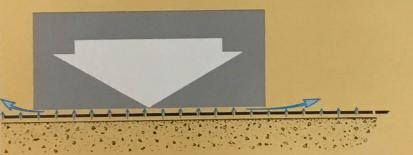
At end of line, tracks have been mounted, Rolair powered lifts raise completed tractor to permit withdrawal of transporter. Tractor then rolls off assembly line under its own power as shown.

The concept of using a film of air to move material isn't new. For many years, it has been used in the paper and textile industries in bulk cutting operations. More recently it's being used in the conveyor field for transporting low density materials. 

What these applications have in common with "air film systems" as the term is applied today in the material handling industry is the use of the lifting force of air and its friction-freeing qualities. In general, however, transporting weight of any significance has not been possible so its application to the material handling industry has been quite limited. 

On the next page you'll see how Rolair engineers have made the air film concept practical for even the heaviest of loads.

# THE PRINCIPLE THAT MAKES AN AIR FILM SYSTEM WORK.

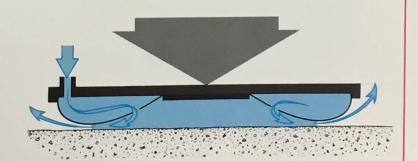


Since 1962 Rolair's engineers have been perfecting the "compliant air bearing" that makes the air film principle suitable for broad application.  $\square$  Air from a compressor or blower is fed into bearings like the one shown below. The bearings inflate, raising the load they carry slightly. As more air is forced into the bearings, some seeps out between the inflated bearings and the floor. This seepage makes the bearings float two or three thousandths of an inch (measured by means of an optical comparator) above the floor surface. Just high enough to make the bearings and the load virtually frictionless, and low enough to keep air consumption at a minimum. And this is the key to an effective air film system.  $\ \square$  Once floating the load can be rotated on its own axis, positioned precisely, and moved with very little effort.  $\Box$  With the Rolair compliant air bearing, our engineers have taken into account the reality that floor surfaces are not mirror smooth. The bearing instantaneously changes shape to match the contours of the surface it is running over. 

To meet this requirement for the fast flexibility that conserves air, the bearings are made of especially compounded elastomerics that resist abrasion, tear, and most chemical environments. 

As a result, running surface limitations are minimized. A sealed smooth concrete floor as found in most modern factories and warehouses is adequate. Just fill in the porous spots and expansion joints. The normal floor then provides an excellent surface.

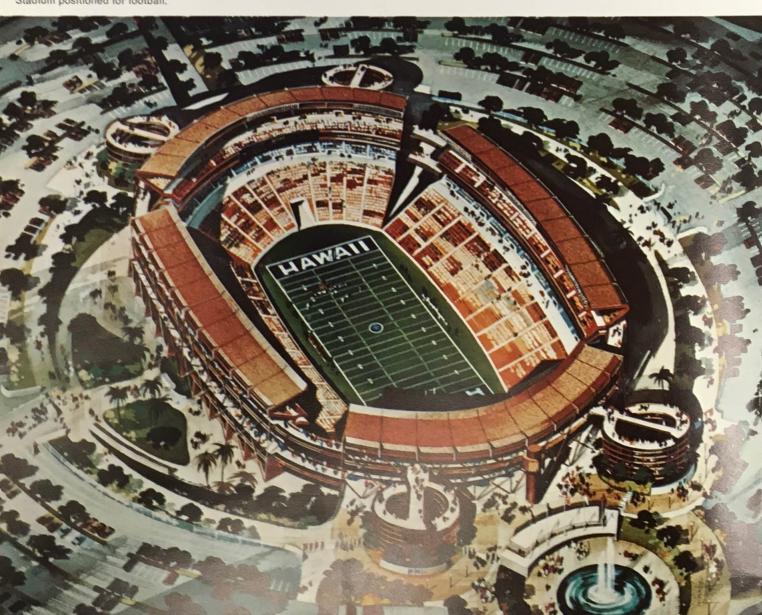
# HOW rolair HAS MADE THIS PRINCIPLE PRACTICAL.



# OAHU STADIUM:

8

Stadium positioned for football.



28,000 PRIME SEATS (7,000 TONS) MOVED AT WILL ON AN AIR FILM SYSTEM CONCEIVED, DESIGNED, BUILT AND INSTALLED BY rolair.

Stadium re-positioned for baseball.





The ideal assembly line should have enough flexibility so that at any time it can be shortened, lengthened, redirected and even relocated; speeds can be altered; different sized products can be mixed; and production rates can vary. This Rolair assembly line for a newly developed excavator meets these criteria with an extra bonus of minimal capital investment.

Preprogrammed automatic Rolair stations control when and how far each vehicle moves, and how long it stays at each station before moving on.



Shop air is the primary power supply at each station. This single air line floats the transporter with its 20 to 45 ton load, operates the traction drive unit and is also the air supply for the assemblers' air tools.

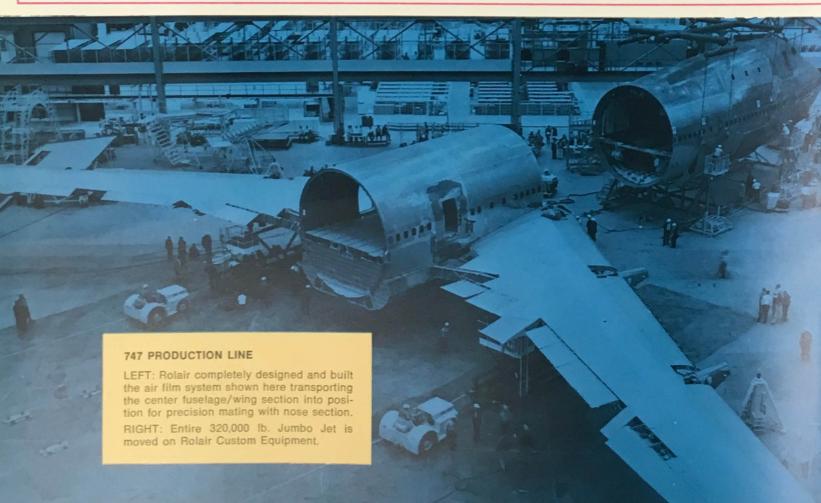
Left: Final subassembly being added.

11





Electrical engine generators weighing up to 20 tons are easily moved throughout this power systems company plant.







Rolair designed, built and installed "OMNI-MOBILE" Crane can be floated to any desired location in this metal fabricating shop within minutes.



We'll be glad to sit down with you at any time to discuss your requirements. And a study to see if a custom designed Rolair system will best meet your needs will be conducted — without obligation, of course. 

This won't be a re-hash of someone else's system. Each Rolair proposal is the result of the study of your particular problem and long hours of solution seeking. 

When you investigate new developments in material handling, include a discussion with Rolair. The investment of an hour or two may bring returns for years to come.

Rolair designed, built and installed this panel line for a major U.S. shipyard. It accurately positions enormous steel plates of varying thicknesses for welding into ship sections weighing up to 100 tons. Then transports them down the line.

# WHEN MATERIAL HANDLING IS A PROBLEM — ROUTINE OR UNUSUAL — CONSIDER rolair.







# **KOPPERS**

The information presented in this portfolio is intended to familiarize you with Koppers complete line of architectural and construction materials.

Each of the folders has been categorized according to the Uniform System for Construction Specifications for your convenience in filing. A folder, listing all Koppers building materials literature, and a sheet of reply cards has been included to assist you in obtaining specification information.

Manager, Architectural Sales

M. Allenters



# ROME'S COLOSSEUM IS BORN AGAIN H.D.&C. CRAFTS ITS

There is a monument in Rome that has been hailed for 1,900 years as one of the greatest architectural and engineering achievements of its age. In Hawaii, work is in progress on a modern counterpart to that marvel of human construction, and a Dillingham company is putting it together.

The Flavian Amphitheater of Rome, more popularly known as the Colosseum, is an aesthetic as well as technical triumph. Standing fragmented on a busy street in Rome today, it is still the most readily recognizable single structure in the Eternal City.

Newsweek editors say it is "hulking, awesome, ageless, always ancient, always silent, always crumbling and ruinous."

Travel guidebooks refer in subtle irony to the mammoth mass of stone as "the greatest ruin of them all."

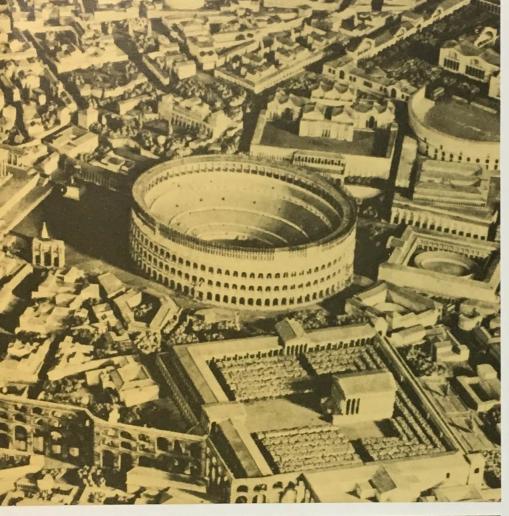
The Colosseum has inspired reams of poetry and descriptive writing through the centuries. Its ancient history has provided Hollywood with many movie scripts, including Academy Award winning films such as "Spartacus," in which dimple-chinned Kirk Douglas relived the plight of one of the most famous gladiators.



That was an era when the bloody and brutal combat of man-againstwild beasts and man-against-man was "sport."

And it is *sport*—certainly less terrifying—that is the raison d'etre of the Oahu Stadium presently in construction in Hawaii. The \$27 million structure is being built at the hands of a hundred employees of Hawaiian Dredging & Construction Co.

The modern stadium is a dream-come-true for Hawaii's sports fans who have waited through seven years, and hundreds of committee meetings, political decisions, negotiations, and planning. The new structure will replace the ramshackle Honolulu Stadium, center of major outdoor sports since the 1930's. It has the dubious distinction of late of being called "Termite Palace."





Even while still under construction, Oahu Stadium in Halawa is drawing praise.

Hal Wood, sports editor of the Honolulu Advertiser, hails it as "big league in every way you can think.

"This stadium is so radical in design that there are some who refuse to believe it will work. It's the only real multiple-purpose stadium ever to be built," wrote Wood.

Jack Quinn, whose Pacific Coast League Hawaii Islanders will have the stadium for their playpen, sums up his feelings in a single statement: "It means a great day for Hawaii."

### Wet and Wild

Like the Colosseum of Rome, Oahu Stadium's unique feature is its total convertibility to meet the needs of different events. The Colosseum had water channels linking the arena to aqueducts, making it possible to flood the field for mock naval battles.

For Oahu Stadium, Charles Luckman Associates, architects, have designed a stadium that will be able to move entire grandstand sections to accommodate either football or baseball configurations. It is the first stadium anywhere to do so on air bearings.

The 50,000-capacity stadium, located east of Pearl Harbor, will sit on a 106-acre site, with parking for 7,100 cars and 70 buses. It will set in a man-made bowl with the playing field approximately 35 feet below the entry level. In a football configuration, the structure will be 800 feet long by 600 feet wide. As a baseball facility, it will be 800 feet by 800 feet. The top of the roof will be 146 feet above the field.

Rome's Colosseum stood over 150 feet high. The huge elliptical arena sprawled across six acres. The enclosed oval arena was about one-third of a mile, measuring 287 feet in length by 180 feet in width.

Seating capacity was 50,000, as Oahu Stadium's will be. Statistically, the Colosseum measures up to the Astrodome in Houston, Texas, the world's largest indoor stadium.

# 80 Ways In and Out

Although no one knows who designed the Colosseum, it is obvious that the ingenious architects considered the spectators' needs, as did Charles Luckman Associates for Oahu Stadium.

At the ancient arena, arches on the ground level served as entry ways to the interior. There were four portals and 76 numbered entrances. Spectators used the numbered entrance corresponding to the number on their ivory tickets, then walked up a broad staircase, and on to a numbered landing and numbered seat. This entry-exit pattern had been planned so carefully that the Colosseum could be emptied in ten minutes. (Handy if the lions got loose.)

There were three tiers of seating in the four-story structure.

Exalted persons of rank sat in a spacious marble terrace that circled the arena. These royal ringside seats were set behind a protective wall.

Above them were tiers of more marble seats for distinguished private citizens of the middle class, with a separate section for slaves and foreigners. The third level was for women and the poor. On the roof of this gallery were stationed the attendants who managed the extensive system of awnings, known as the *velarium*, that shielded spectators from rain and sun.

Thus, the Roman spectators settled back in comfort to watch the era's blood baths that began at dawn and sometimes lasted far into the night. (At Oahu Stadium, results of games fans will see won't be as "final." Scores like Lions 6, Christians 0, are not expected.)

# **People Movers**

Hawaii's stadium will have six main entrances and 50 exits. People entering the stadium will use spiral ramps and move within the stadium to their seats by means of other ramps and concourses. There will be an escalator on each side of the stadium providing 27 feet of vertical travel; two elevators; and eight bridges.

It's going to be a toss-up which will be more spectacular at the new facility—the games, or the fully automatic, intricate mechanical maneuvers of changing the stadium from one form to another.

The stadium incorporates several innovative engineering features, but storage and movement of the eight concrete-topped steel bridges are especially noteworthy. The bridges are to be stored for baseball and used for the football configuration.

How does one get eight 100-footlong, 80,000-pound bridges out of the way one time and up in minutes another time? Easy.

HD&C assistant project manager Jim Perry described the process:

"The bridges will be stored in a nested position one on top of the other in sets of two under the fixed stands. To move them from the storage position, air bearings will be employed in connection with fork lifts.

"The lift mechanism is a hydraulic air-operated ram, 30 inches in diameter, that is housed in a concrete and steel case that extends 104 feet underground.

"In a retracted position, the ram is flush with the concrete runway surface and filled with 1,275 gallons of hydraulic oil. To actuate the ram, air is connected to the top

of the ram and introduced under 155 psi pressure.

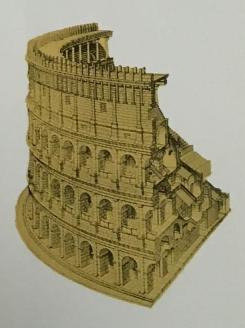
"The bridges are designed so that the ram runs through the bottom of the nested bridges and lifts the top 80,000-pound bridge 86 feet into the air at five feet per minute. The ram then retracts and a plate is placed over the hole of the bottom bridge. That bridge is then lifted 33 feet into position. All bridges are fixed in position by means of mechanical pull. Removal is simply a reversal of the process."

For football, Oahu Stadium will take on an elongated, oval shape. For baseball, it will be an openended double horseshoe configuration.

# Shapely and Smart

There will be fixed grandstands at either end of the stadium, one at the north (outfield) end and the other at the south (infield) end.

In between these grandstands will be four movable stands. These stands will move in predetermined patterns to form the two configurations. They will swing through an





arch of approximately 40 degrees, or 100 feet, on pivot points located on the fixed stand.

For football, there will be 28,000 seats situated between the goal lines, with the front 50-yard-line seat about 45 feet from the side lines.

For baseball, there will be 24,000 seats along the foul lines, 13,000 of them between first and third base.

According to Perry, an avid baseball fan, "in order to hit a homerun in this park, it will take a poke of 321 feet along the foul lines and 420 feet to dead centerfield. Batters will also have to hit over a 30-foot-high screen that will be located at centerfield."

## Pick a Sport

How versatile will the new stadium be? If the minor league world series had been scheduled for Oahu Stadium last year, during which time local schools were battling for their football pennants, here's how the quick-change stadium would have been used:

On Friday afternoon, there would be a high school football game. Friday evening, a world series baseball game would be played. Saturday afternoon, baseball again. That evening, the University of Hawaii would meet an opponent in college football. Sunday afternoon and night, more baseball.

It takes only 20 minutes to move each seating section into place. Each is moved sequentially. If all mechanisms (seating sections, bridge lifts, etc.) move at the designated speeds, HD&C estimators say it will take 2½ hours to make the total conversion from one configuration to the other.

HD&C was successful bidder on all three phases of stadium construction. Phase I (\$300,000) called for realignment of a stream that ran through the property, as well as moving underground utility lines. Phase II (\$1.3 million) is site development of 102 acres. Phase III (\$27 million) is the stadium construction.

Oahu Stadium will be built of concrete and steel. Fabrication of the weathering and non-weathering steel to be used is being done in Provo, Utah by Mountain State Steel, under contract from Hawaii Welding. The first shipment to Hawaii was in January and final shipment will be July 1973. A total of 11,000 tons of steel will be used.

There will be 27,000 cubic yards of concrete in the structure. Bleacher sections for lower stands will be prestressed, precast concrete components.

HD&C is expected to put it all together in 350 working days.

## Creating the Colosseum

The Colosseum took much longer, 24 years, to complete. Construction, directed at first by the Emperor Vespasian, began in 72 A.D. Work continued under his sons, Titus and Domitian, up until 96 A.D.

The ancient amphitheater was basically an interlocking system of vaulting arches and hollow shells. Apart from the statues that adorned the Colosseum, externally it was severely plain.

Many different materials went into the Colosseum, but huge travertine blocks were used for the most important structural functions. The outer framework and skeleton of the interior up to the second story were built of travertine, a limestone found in Tivoli. Softer stones and concrete completed the structure.

Peter Quennell, in *The Colosseum* wrote that the builders of the

amphitheater seemed to have used the same principles now employed by architects who work in steel and ferroconcrete. The Colosseum masons did not use mortar; they inserted iron clamps to hold blocks in place.

The Colosseum had a skeleton framework of concentric piers and arches, linked to travertine rings with a series of connecting lateral walls. Walls on the upper floors were made of brick and concrete; lower floors were made of tufa or volcanic stone. Vaults were constructed of pumice stone.

## Strictly for Looks

The fourth story of the Colosseum was set with Corinthian pilasters, and a range of narrow quadrangular windows pierced the wall between every other pair. Superimposed pilasters gave the structure a vertical, upward effect. Visitors still say that the Colosseum towers to a fantastic and dizzy height because of the illusion. The sheer size of the famous amphitheater inspired awe.

The pilasters were actually dummy columns, which emerged partly from a wall or support behind it. They contributed to the appearance of the building, but did not give any actual support. There were 80 sets of these, one above the other.

The Colosseum today contains barely a third of its original materials. It was used as a "quarry" in the 16th and 17th centuries when stones were stripped to build churches and private palaces in Rome.

Yet it remains a symbol of Rome's eternity and its people's creative genius. The famous monument has survived repeated vandalism and looting, several major earthquakes, lightning strikes, civil warfare, the tramping of generations of tourists, the swirling stream of vehicles that move around its walls, and the effects of noxious air.

And, 12,000 miles away another arena dedicated to sport, but dressed in 20th century creativity is about to be born.

## **OAHU STADIUM**

Location: Halawa district, Oahu, Hawaii.

Year started: 1972

Year to be completed: 1974

Size: 146 feet high.

800 by 800 feet (baseball)

800 by 600 feet (football)

Occupies 106 acres.

Capacity: 50,000.

Owner: State of Hawaii

Architect: Charles Luckman Associates.

General Contractor: Hawaiian Dredging & Construction Co.,

division of Dillingham Corp.

Structural engineers: Erkel-Greenfield Associates and

T.Y. Lin Hawaii Inc.

Steel fabricators: Mountain States Steel, division of Diversified

Earth Sciences Co. (under contract to Hawaii Welding.)

Landscaper: Philip P. Minn

Principal HD&C personnel:

Gordon Scruton, construction manager

Frank A. Gould, project manager

James R. Perry, assistant project manager

Jack H. Hussey, senior project engineer

Stan Yagi, superintendent-building

Ernest Souza, superintendent-sitework

Stan Osada, superintendent-bridges

Steve Zachman, superintendent-piledriving

## COLOSSEUM

(Flavian Amphitheater)

Location: Rome, Italy. On site of lake that once

beautified gardens of Nero's Golden House.

Year started: 72 A.D.

Year completed: 96 A.D.

Size: Four stories, 150 feet high.

Arena 620 by 513 feet

Occupied six acres.

Capacity: 50,000

Owner: Citizens of Rome

Built by: Slaves and Jewish prisoners of war.

Architect: Unknown

Landscaper: Probus

Principal creator: The Flavian Emperors Vespasian,

Titus and Domitian.





## **AIR FILM APPLICATION ANALYSIS**

P.O. BOX 30363 ■ SANTA BARBARA, CALIFORNIA 93105 ■ TELEPHONE (805) 968-1536

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SKETCH OF OPERATION

## LOAD DESCRIPTION ARE DRAWINGS OR PHOTOS ENCLOSED? WEIGHT\_\_\_\_ DESCRIPTION OF LOAD INTERFACE WITH ROLAIR EQUIPMENT\_\_\_\_\_ ADDITIONAL COMMENTS\_\_\_\_\_ SKETCH OF LOAD (SHOW THREE VIEWS, DIMENSIONS AND CENTER OF GRAVITY LOCATION) LOAD PLACEMENT AIR FILM EQUIPMENT TO BE INSTALLED PERMANENTLY UNDER LOAD AIR FILM TO BE FLOATED UNDER LOAD UNIT WITH PICK-UP CAPABILITY LOAD TO BE PLACED ON AIR FILM EQUIPMENT BY OTHER MEANS: ADDITIONAL COMMENTS:\_\_\_

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	MANPOWER ROLAIR ON-BOARD DRIVE UNIT ROLAIR DETACHABLE TUGGER						
ROLAIR TO FURNISH TOW VEHICLE CUSTOMER TO FURNISH TOW VEHICLE							
(	OTHER:						
COM	MENTS:						
AIF	R SOURCE						
,	FACILITY SUPPLY: COMPRESSOR RATING:SCFM @PSI.						
,	AIR RECEIVER CAPACITY:CU. FT. FREE AIR @PSI;						
	ORCU. FT. VOLUME: ORGALS. VOLUME.						
1	MAIN LINE:						
	HOOK UP:(TYPE) VALVE(MFG.);						
	OR ; OR (MFG.)						
	REGULATOR MODEL NO MEASURED MAIN LINE MINIMUM						
	PRESSURE: PSI. AMOUNT OF AIR CONSUMED BY OTHER FUNCTIONS: SCFM;						
	BALANCE AVAILABLE FOR AIR FILM EQUIPMENT SCFM.						
	ROLAIR TO PROVIDE AIR SOURCE: STANDARD STATIONARY COMPRESSOR						
	OTHER						
_							
RO	LAIR EQUIPMENT OF INTEREST (SEE ROLAIR CATOLOG)						
	STANDARD TRANSPORTERS: P1 R3 R4 B6						
	TRANSPORTER ACCESSORIES: DRIVE UNIT FIXED CONTROL HANDLE						
	GUIDE WHEEL REMOTE CONTROL UNIT HANDLE BAR TOW BAR						
	☐ TRANSIT WHEELS ☐ HOSE REEL ☐ LIFTERS ☐ SKID ADAPTERS						
	SPECIAL SUPERSTRUCTURE SAFETY QUICK COUPLER						
	ST BEARINGS SJ BEARINGS ELECTRIC TRANSPORTERS						
AL	TERNATIVE TO USING AIR FILM						
	TYPE OF EQUIPMENT						
	COST OF EQUIPMENT COST OF INSTALLATION						
	LEAD TIME DISADVANTAGES:						

DOVERSE SECTION

FLOOR SURFACE (PHOTOGRAPHS ARE HELPFUL)  TYPE AND TEXTURE: NEW FLOOR OLD FLOOR, AGEYEARS.
CONCRETE:
UNSEALED SEALED TO SHEEN
VERY SMOOTH MODERN WAREHOUSE TEXTURE SLIGHT ROUGHNESS
DEGRADED DEGRADED WITH AGREGATE SHOWING
SIDEWALK TEXTURE HIGHWAY TEXTURE
ASPHALT:
VERY SMOOTH (NO AGREGATE SHOWING) MEDIUM AGREGATE SHOWING
ROUGH AGREGATE SHOWING UNSEALED SEALED
STEEL PLATE:
CLEAN PAINTED: SMOOTH ROUGH RUSTY
DIAMOND PLATE OR EQUIVALENT
OTHER: (DESCRIBE)
EXPANSION & CONSTRUCTION JOINTS:  NOT FILLED FLUSH: "DEPTH LINEAL FOOTAGE  FILLED FLUSH - DESCRIBE MATERIAL
CRACKS: " AVERAGE WIDTH; " AVERAGE DEPTH; TOTAL LINEAL FOOTAGE
HOLES: (SPALL MARKS, DRAINS, ETC.) MANY FEW
LEVELNESS: SLOPE " IN 10 FEET; OR%.
UNDULATIONS:
OBSTACLES: (RAILS, PROTRUSIONS, ETC.) DESCRIBE
SURFACE CLEANLINESS: VERY CLEAN DIRT
SOLID DEBRIS (DESCRIBE)
LIQUIDS (DESCRIBE)
ADDITIONAL COMMENTS:

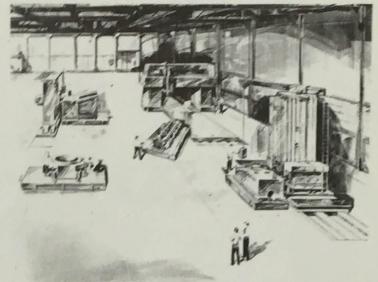
# TEACHTONES.

roldir SYSTEMS, INC.

REPRINT OF ARTICLE APPEARING IN NOVEMBER - DECEMBER ISSUE OF "PACIFIC FACTORY"

# Air film system for transporting heavy workpieces

Machine utilization is said to increase 30%



Workpieces can be setup away from the machine tools, floated into place and accurately positioned with the Omni-Mobile Bed Plate System. It is said to permit a 30 percent increase in machine tool utilization.

Machine downtime for workpiece setup has been a continuing problem in machining operations. Typically, in milling, boring and drilling operations, machine utilization is under 50 percent.

A newly developed workpiece transporter system that floats on air is intended to increase machine productivity up to 80 percent machine utilization or more.

Developed by Rolair Systems, Inc., Santa Barbara, the Omni-Mobile Tool Bed Plate system combines an air film system for transporting castings and similar workpieces with flush-to-floor docking points for precise alignment at the machine.

With the Rolair Omni-Mobile Bed Plate system, the workpiece is setup away from the machining operations on a specially machined transporter. After setup, the transporter is floated on air to the machine and is precisely positioned on the docking points.

In subsequent operations, as a machining step is completed, the transporter can be rotated. For example, it could be rotated 180° for machining on the opposite face of the workpiece. Or, the transporter can be floated to another machine within the machine tool complex. In this situation, a second transporter with a new workpiece from the setup area can be positioned at the first machine in minutes.

The repeatable, precise positioning possible at various machine tools permits a manufacturer to use a series of less expensive single-function machine tools rather than machining centers that incorporate multiple machining operations and require costly setup times.

According to Robert B. Keiding, vice president of Rolair, "This approach now makes it possible for a machine tool to be used to full capacity. No longer is costly

machining time lost because of setup delays, or lost while waiting for overhead crane availability. The result is a much higher rate of productivity."

The Rolair transporter used in the Omni-Mobile Bed Plate system resembles a standard machine tool bed plate. It has standard 1-inch T-slots on 12-inch centers (keyslots and other spacings available). Mounted in the slots are key-type fixtures which are used to locate and hold the workpiece.

Once a workpiece has been setup on the transporter, the air film system is activated using the standard shop air supply. Key to the air film system are the air bearings located underneath the transporter.

The air bearings operate on a rather simple principle. A thin film of air between the load and the floor serves as a lubricant and virtually eliminates friction which results in almost effortless movement of even the heaviest loads.

An air bearing resembles a saucer-like disc and is a specially compounded elastomeric compliant diaphragm. When air is fed into the bearing, it inflates, a shallow bubble of air is trapped and the load is lifted slightly. As the air flow continues, the bearing design permits air to "leak" evenly around the edges and the load is then supported on a thin film of air. Friction is virtually eliminated and the load can be moved with little effort in any horizontal direction achieving "omni-mobile" characteristics.

With the Rolair Mobile Bed Plate system, the setup workpiece is floated from the setup area onto flush-to-floor docking points adjacent to the machine tool. A built-in, directional air-powered drive system provides propulsion.

The transporter is then precisely positioned using tapered shot pins which

engage receptacles located in the docking area. When the air supply is turned off, the transporter gently settles onto precisely leveled machined rest pads located on the undercarriage of the transporter and on the docking points. This keeps the transporter and workpiece in a precise, repeatable position in the X, Y and Z axis. Positioning within .001 inch is possible.

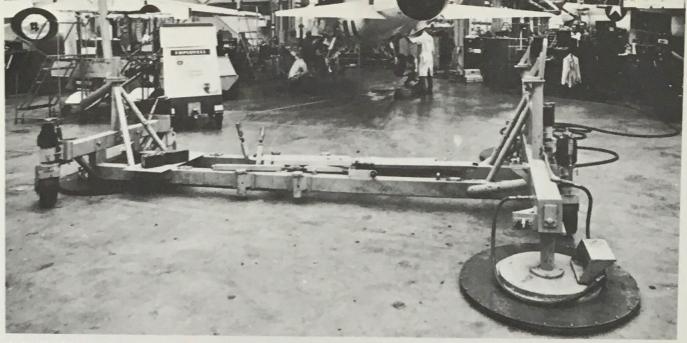
During machining operations, it it is necessary to reposition the workpiece, the air supply is simply reactivated and the transporter can be positioned within minutes for the next operation.

When the machining operation is complete, the transporter is floated away. In the meantime, any other workpieces can be readied for machining on other Rolair transporters in a "staging area" away from the machine. Standard capacities range from 7.5 to 300 tons.

Propulsion is provided by two or more directional drive wheels located underneath the transporter that are driven by air powered motors. The operator can control the speed of movement from 0 to 120 feet per minute. Also, the operator can retract the wheels when precise, manual positioning of the transporter over the shotpin receptacles is required.

The control console used with the Mobile Bed Plate system can be positioned on any part of the transporter providing the operator with an unobstructed view for guiding the transporter. Or, the control console, because of its umbillical nature, can be detached from the transporter and used as a portable device.

For further information on the Omni-Mobile Machine Tool Bed Plate system, may be obtained from Rolair Systems, Inc., P.O. Box 30363, Santa Barbara, CA 93105.



AIR-FILM DOLLY cuts aircraft handling time and adds to safety. Air is taken from standard plant air lines.

# Making it really easy to position 9½-ton loads

Air-film dollies that position 19,000lb jet fighters have cut handling time and provided a safer testing environment for Vought Aeronautics Div., LTV Aerospace Corp., Dallas.

To help maneuver the aircraft into position for final outfitting, the company uses three air bearings (Rolair Systems Inc.) which are connected to a T-shaped dolly.

Simple "on-off" air-valve controls for the air bearings are operated by a single employee. The bearings are equipped with their own stabilizing chamber which eliminates any throttling of incoming air. Air pressure is supplied at 75 psig from standard 1-inch air lines.

The air bearings have elastomeric diaphragms that are inflated during operation. Controlled leakage creates a layer of air between the bearing and floor.

Although one man can easily push the 9½-ton jet, supported only by the air dolly, three men usually hand-maneuver the aircraft.

In most instances, the air dollies are used with an overhead crane. This insures fine positioning of the aircraft for outfitting and testing of gears, wheels, and other operational and emergency devices.

"We feel it's safer to have the aircraft on an air dolly during the testing of operational equipment. Previously we used hand-operated jacks and there always was the chance the aircraft would jump these jacks," says Phil Spaulding, manufacturing engineer.

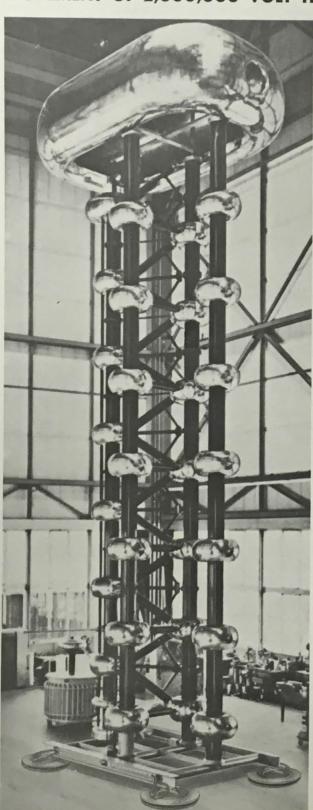
Six of the air film dollies have been in use for nearly two years. In that time only four diaphragms have been replaced even though they must resist abrasions and tears caused by screws, bolts, and bits of metal.



**DOLLY IS POSITIONED** under fuselage held by crane. One man can push 19,000-lb aircraft easily but three are used for exact positioning.



## MOVEMENT OF 2,000,000 VOLT TEST TOWER



Two million volt test tower with extremely high center of gravity is moved on four ROLAIR 44S air bearings which are supplied with air from a standard industrial compressor.



Two men easily move tower omnidirectionally throughout manufacturers' and users' facility.

## **PROBLEM**

Economic movement of very large, expensive and delicate electrical equipment during manufacture, test and installation. Equipment is more than five times higher than it is wide. Weights exceed 50,000 pounds.

Methods considered were:

- Wheeled Dolleys Difficult to move and maneuver. Create shock jolting to the delicate equipment.
- Rail System Expensive, inflexible routing, creates shock jolting to equipment.
- Air Film System System selected.

## SOLUTION

ROLAIR provided a system incorporating four 44 S structural air bearings interconnected by a hose manifold and powered by standard shop air.

## **RESULTS**

- Labor Reduction Two men were able to move the equipment throughout the production area.
- Flexibility The extremely bulky towers were moved easily through confined areas using the omnidirectional feature of air film.
- Capital Equipment Investment Capital equipment investment was low and equipment can be used over and over on a variety of jobs.
- No Facility Damage ROLAIR bearings can move heavy machinery without floor damage of any degree.

Customer reports "these air bearings are used with great success on the above mentioned installation and can also be installed on other equipment such as high voltage rectifiers or testing transformers. It is our intention to introduce the air film system as a standard solution to our customers for our movable high voltage test equipment."





## MOVING AUDIENCES ON TELEVISION



Each Saturday night, the entire audience is moved on the Andy Williams Show on bleachers floating on ROLAIR ST Series bearings.



The ROLAIR bearings receive air from bottles. Operator is shown preparing to move the audience on air.



Two men — one at each end of the bleachers — move the audience while the show continues.

## **PROBLEM**

Andy Williams wanted a permanent orchestra section on stage at all times and audience seating that would allow him to work "in the round." The problem boiled down to how to have an orchestra set, intimate audience seating, and still have room for large production numbers all within the confines of a television studio.

## SOLUTION

ROLAIR ST bearings were chosen to economically, quietly and easily move two half moon seating sections into various positions during the production. Compressed air bottles were used as a convenient and quiet source of air.

## **RESULTS**

- Economy Six standard ST Series air bearings move each section for a cost of less than \$500.
- Flexibility Two men can move a section in any direction without any facility modification.
- No Facility Damage ROLAIR bearings float over the studio floors without mark.
- Versatility The ROLAIR bearings can be used to move a variety of loads in addition to the seating sections.

"When a script calls for a production number, the stage hands throw a switch and turn their airborne audience to face the other end of the studio . . . even visiting Astronaut John Glenn tried it out and found himself back in orbit again."

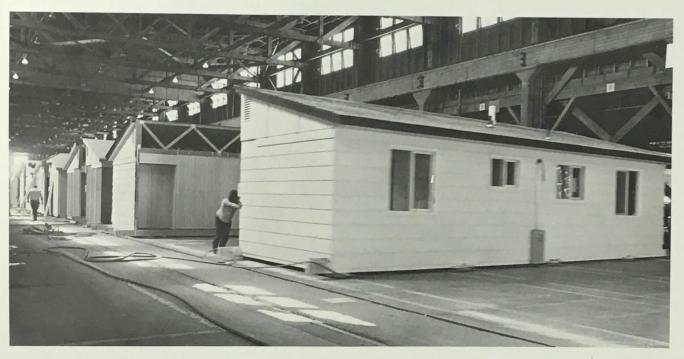
Los Angeles Herald-Examiner





## Case Study No. 101A

## MODULAR HOME PRODUCTION LINE



Factory built home modules moving down production line on ROLAIR air film equipment. Each 16,000 pound unit is moved by two men exerting a combined force of approximately 16 pounds.



ST Series ROLAIR bearing shown installed. Bearing need not be attached to load.



Old, rough warehouse floor improved only along path of air bearings (Note parallel lines).

## **PROBLEM**

Economic movement of factory built home modules weighing from a few thousand pounds at the beginning of the line to ultimate weight ranging from 10,000 to 30,000 pounds and over down a production line.

Methods considered were:

- Rail Systems Expensive, inflexible and difficult to move.
- Caster System High rolling forces require excessive manpower to move.
- Crane System Very expensive, inflexible, and limited to one unit movements.
- Air Film System Selected approach.

## SOLUTION

ROLAIR supplied catalog equipment consisting of eight 18" ST Series compliant air bearings and one interconnecting air manifold per home module. Available shop air was utilized to operate bearings — 50 psi at 60 cfm. Floor surface was sealed by customer's maintenance personnel, but only in narrow track over which the ROLAIR bearings traveled. ROLAIR floor sealer R-1136 was applied at very low cost.

## **RESULTS**

- Labor Reduction Eliminated ten men during station-to-station movement phases. ROLAIR System allowed two men to effortlessly move each module.
- Capital Equipment Investment Capital equipment investment was substantially lower than other feasible alternatives.
- Production Line Flexibility Omnidirectional characteristic of ROLAIR bearings permits rerouting of production line without any facility modification or extra cost.



## Air cushion helps move beer equipment

Reprint From BEVERAGE INDUSTRY August 24, 1973

When a major brewery decided to expand its brewing and can packaging facility, one important prerequisite was that the expansion activities not interfere with normal operations.

However, with the expansion area located within the brewery's present facility, a problem developed as the canning, packaging and processing machinery being installed in the expansion area had to move about 1500 feet through the heart of the facility. Involved were approximately thirty machines weighing between 15,000 and 50,000 pounds and ranging in size up to 25-feet-by-12-feet.

According to William Braden, regional manager for American Can Company's packaging systems division which supplied the packaging and processing machinery, "We were faced with a potentially expensive problem. The route through the plant was not direct. We had to move through aisles and work areas with several 90-degree turns with little room for manuevering. And, as we had to pass below overhead conveyors, we couldn't use an overhead crane."

Braden explained an additional problem was that the route was not the same for each machine. "As we moved each machine into the plant, we needed to use different routes through the aisles and available areas to minimize any disruption of the plant's operation."

Being used to move the machinery through the maze of aisles and machinery are four standard air bearings manufac-



A portable air compressor provides the air source for the air bearings as the massive filter is moved down the aisle.



Only two men are required to manuever one of the 30 canning and processing machines around a corner on the way to the installation site in the plant.



The air bearings which create a thin cushion of air beneath the machine make it easy to position them into the precise spot where they will be required.

tured by Rolair Systems, Inc., Santa Barbara, California.

"Air bearings were the only practical answer," said Braden. "We had experimented using a wheeled vehicle, but it took us seven hours to move one machine through the plant. With air bearings, we can move a machine in about one hour."

Manueverability was another problem solved with air bearings. "We found that we couldn't get the machines around tight corners with a wheeled or roller-type vehicle. The air bearings allow us to manuever with little difficulty," Braden said.

The Rolair air bearings being used by American Can, operate on a rather simple principle. A thin film of air between the load and the floor will act as a lubricant and will virtually eliminate friction and will provide almost effortless movement of the load.

The air bearing resembles a saucer-like disk and is a specially compounded elastomeric compliant diaphragm. When air is fed into the bearing from an ordinary air compressor, the bearing inflates, a shallow bubble of air is trapped and the load is lifted slightly. As the air flow continues, the bearings are designed so that air "leaks" evenly around the edges and the load is then floated on a thin film of air. Friction is virtually eliminated and the load can be moved in any horizontal direction.

Another problem solved through the use of the air bearings was concern about the load bearing on the concrete floors in an area where the load had to pass over several hundred feet of a tunnel system.

Braden said, "If we used a wheeled or roller system, we were concerned as weight distribution would be concentrated on the point where the roller met the floor. And, we felt that the load bearing would be too great on the structural members of the tunnel."

With the Rolair bearings, the downward force exerted on the floor is distributed over a broad area reducing weight distribution. And, the bearings can be strategically located to minimize load distribution. Another advantage was, as the load is floated, there was no danger of the load chipping the concrete finish.

The air bearings are located under the machine at the loading dock. As each bearing can be individually positioned, and type of configuration is possible to handle different sized and shaped loads. The machine is simply jacked-up and the bearings slid underneath. As the bearings have structural steel caps, they can be placed under the frame of the machine without shoring up the frame.

At the brewery, a lift truck is used to tow the machines once they are on the air bearings. A portable air compressor is used as the air source. Braden explained, "Even though two or three men could easily push the load, we felt it would be easier to tow it. We use men only in special situations."

A concern that the engineers had in the beginning was the ability of the air bearings to operate on the different types of floors in the brewery. The floors are normal warehouse floors.

According to Braden, "We didn't use any special sealants and even didn't bother to fill the cracks. And, the final destination of the machines is in an area



Beer can tin sheets were used to overcome seam between concrete and paver tile. where the floor is constructed of paver tile. Because of the many seams between bricks, it is not the type of surface you would normally select for an air bearing application."

During the moving of the machines, no problems were encountered. Even on the tile floor which had other disadvantages for an air bearing such as drainage areas that had a compound angle and slope of 3-to-4 inches in 10 feet, the air bearings performed without problems. At one point where the tile floor met the concrete, there was a seam that presented a problem. But, this was solved by placing ordinary beer can tin sheet over the seam.

"The Rolair air bearings were even helpful when the machine arrived in the expansion area," Braden explained. "Because you can precisely position awkward loads on air, it was simple to float the load into its final position and simply remove the air bearings."

The success that American Can and the brewery has had with the air bearings was demonstrated when the brewery decided to keep them as maintenance tools.

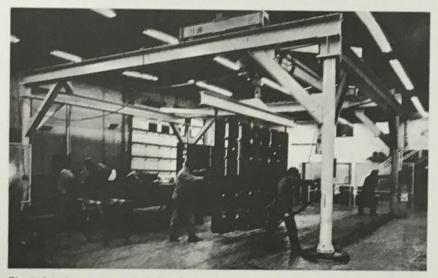
## MATERIAL HANDLING ROUNDUP

Edited by Leo Spector .

## Portable Overhead Crane Floats on Air Film

A MOBILE OVERHEAD CRANE unit that floats on a thin film of air has been developed by Rolair Systems, Inc., Santa Barbara, CA. Supported on air bearings mounted at its base, the Omni-

Mobile crane is claimed to provide flexibility of movement that is not possible with conventional traveling cranes, resulting in significant cost savings. Standard models include a gantry-type crane with



Floated on base-mounted air bearings, overhead traveling-bridge type crane, carrying a 4000-lb load, is easily moved by two men. Because of its freedom of movement, the crane can be moved around obstacles and positioned anywhere.

traveling hook and a traveling bridge type. Load capacities range from 5 to 30 tons; however, units with greater capacities can be engineered to meet specific requirements.

The air bearings used to support the crane have an elastomeric diaphragm that inflates when compressed air is introduced from either the standard shop supply or a separate compressor. This air escapes around the bearing perimeter, forming a thin lubricating film that lifts the crane slightly and virtually eliminates friction, making it possible to relocate the crane easily by pushing it to a new loca-

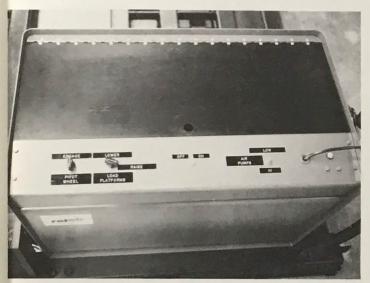


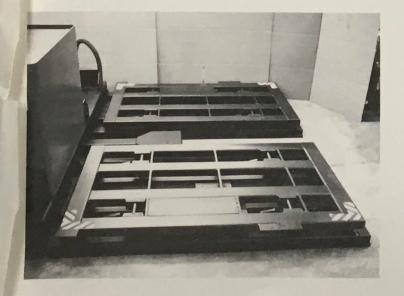
Gantry-type, air-supported crane is used to move a 4000-lb load onto a flatbed truck parked in a plant yard. Use of the crane is not restricted to any location inside or outside the plant as long as the surface is capable of supporting the load and handling the air film.

tion. Because of the ease with which it can be moved, the crane can be precisely positioned anywhere inside or outside the plant. Brakes are not necessary to hold the crane in position; when air is turned off, the crane base settles to the surface underneath and rests solidly on specially designed support points.

This feature of portability offers some practical benefits. For example, if a company is using a leased facility, the installation of a conventional overhead crane system represents a nonremovable improvement and, thus, a nonrecoverable capital investment. With the portable crane, if the company moves, it can take the crane along. In addition, the crane can be easily moved between bays or out to the plant yard, and its installation does not involve the structural costs associated with conventional overhead crane systems.







## OVER-ALL TRANSPORTER

- 16,000 Pound Capacity
- 17 Foot High Load
- Industrial Battery Powered
- Retractable Pivot Wheel
- Deadman Remote Control

## CONTROL PANEL

- Retractable Pivot Wheel
- Load Platform Lift
- High and Low Speed Air

## LOAD PLATFORMS

- Air Cylinder Operated
- Shown in Raised Position





DESIGNS

July July

COLORS

**TEXTURES** 

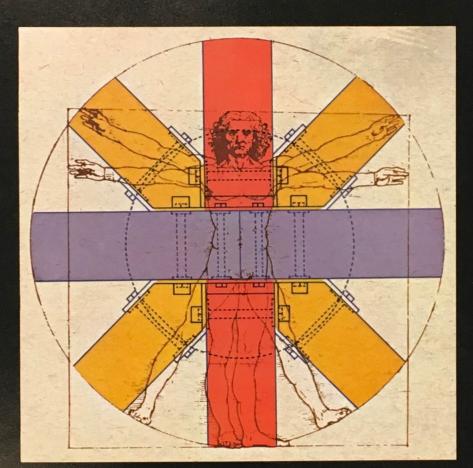
SURFACES



A good design idea goes searching for the right building material. A good material goes searching for the right design. Here are examples of a number of places where the two have come together, and where the right materials and building products have come from Koppers.

Some of these design ideas have been featured in recent Koppers advertisements in architectural and engineering publications. Others are published here for the first time. For your convenience, all are designated by their categories under the Uniform System for Construction Specifications as approved by the American Institute of Architects, Construction Specifications Institute, and Associated General Contractors of America. Inc. clated General Contractors of America, Inc.





By appearance and substance, this is definitely wood. By characteristics, it is virtually a new material. Laminated wood structurals are pressure treated by Koppers to resist rot and termites. Bonded together with superstrong Koppers waterproof adhesives, the laminates have amazing structural strength for long, clear spans, sweeping curves, and dramatic arches. And in industrial environments, this "new material" is practically invulnerable to corrosive agents that attack steel and concrete.

This is the stuff of trees, improved as far as we know how to improve it. But the warmth, texture, and grain are unmistakably wood, and who can improve on that?

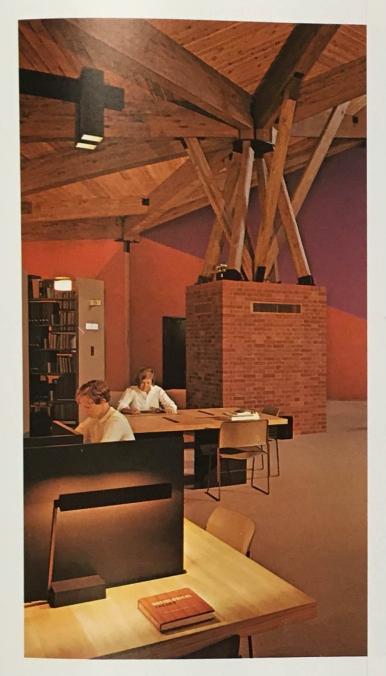
The bouquet description was given by one of the students at Wells College where the Louis Jefferson Long Library was recently completed. It is apt because the multiple traverse system involved nine different floor pods, three floor levels and 84 separate roof planes. The 550 laminated wood structurals range in length from 8' to 36', in widths from 5" to 11", and in depths from 8" to 13". Almost 39,000 board feet of western red cedar was used for the 3" x 6" and 4" x 6" double tongue and groove decking. The library's 55,000 square feet

include stack space for 250,000 volumes, seating capacity for 328 people, various study environments, seminar rooms, a music listening area, a rare book room, a permanent art gallery, and a room which is planned for electronic carrels for information retrieval from library centers.

Because of the numerous elevations and roof planes, every laminated structural member was customfabricated by Koppers with varying dimensions, angles of cut, and locations of connections. To coordinate the roof construction a "hot line" was set up between the architect's office in Chicago, the Koppers plant at Peshtigo, Wisconsin, and the job site in Aurora, New York. The shop production drawings were used as blue prints for erection, and only one minor on-the-site modification was made in putting the entire system in place. The job was completed in only 165 working days, from the start of drawings to placement of the decking.

Architect: Skidmore, Owings & Merrill, Chicago, Illinois

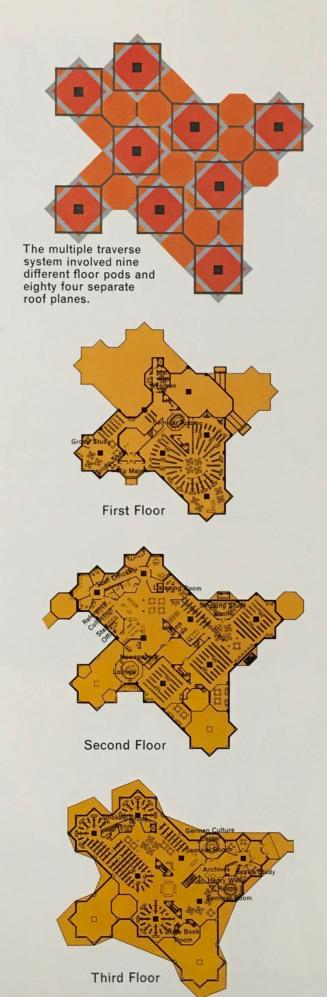




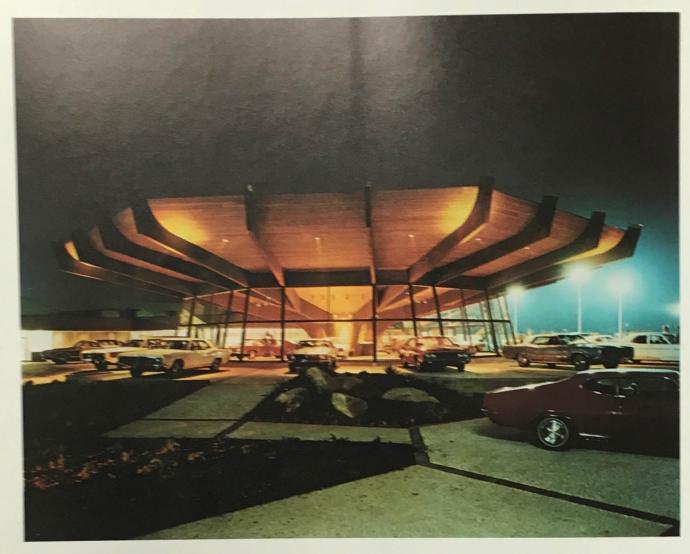
The roof is supported by brick exterior walls, single laminated wood columns, and clusters of laminated beams that rise from brick piers which also hold ductwork. Eight laminated beams make up each cluster; four anchored at the corners of the pier and meeting at the roof, and four anchored at the center and flaring out to the roof. See the drawings for connection details.



BASE PLATE SHOE DETAIL



WELLS COLLEGE PLANS



It could be a space station. It could be an awant garde cultural center. But the most striking addition in years to the Raleigh, North Carolina, cityscape is actually an auto dealer's shownoom. It embodies the opinion of Ford Dealer William M. Sanders and architect William Sigmon of Olsen Associates that there is no reason to sell cars in a conventional building—in fact, there is every reason not to.

Already the talk of Raleigh, the structure has also become a memorable visual symbol for Sanders Motor Company, its basic shape incorporated in all of the company's advertising and identifying graphics, right down to emblems on salesmen's blazers.

Upswept beams are laminated wood,

made with Southern Pine and given a dark brown finish at the Koppers Company plant in Morrisville, North Carolina. Roof decking is three layer laminated wood with a hemlock layer visible, factory-stained in a light honey color. Structurals were pre-engineered and fabricated to precise tolerances at the Koppers plant, then shipped to Raleigh by truck. Pressure-treated by Koppers exclusive Cellon® process, the wood is fully protected from weather, rot, or termite attack.

The showroom building consists of eight main laminated beams joined at the center column. Supporting these main beams, sixteen additional laminated beams join midway and continue to the top of the roof line. Beams are connected by metal

hardware, and structural steel supports are disguised as part of the window framing to give a floating effect.

Ends of the beams are capped in copper. Windows in the showroom are held in place by metal channels anodized in a dull, bronze color to match the beams, and flooring is brown brick instead of the usual glossy tile. Coupled with the soft tones and textures of wood, these surfaces provide contrast instead of competition for the gleaming new cars that the building is designed to showcase.

Cost of the showroom buildings was about \$10.50 per square foot.

Architect: Olsen Associates, Raleigh, North Carolina

> Koppers Company, Inc. Pittsburgh, Pa. 15219

## **KOPPERS**

Architectural and Construction Materials







Here's a school construction story to warm any taxpayer's heart. It's the new Central High School at Natchitoches, Louisiana. Housing 1,000 students, the structure was completed for \$1,540,808, including land acquisition.

Architect Oscar C. Butler credited the low cost per square foot to Koppers exposed laminated wood beams and arches in the common roof system joining the six circular pods. "Cost of other structurals and their required concealment for interior beauty would have jumped our construction costs considerably. Another cost-savings factor," he added, "was the ease of handling the wood laminates and speed of erection." Nearly 700 laminated wood beams and arches were used in the school. The teak-finished structurals add a touch of warmth and graceful symmetry to the interior design. Most of the sections radiate like spokes from the hub of a wheel on each pod. Others flare out from the perimeter walls of the pods to frame corridors, the main entrance lobby, and a spacious student commons area (combination auditorium and dining room).

With 87,500 square feet of floor space, the total cost averaged \$13.94 per square foot, about 20-25% under the rule-of-thumb figures advanced by architects and builders for present-day school construction.

Architect: Butler & Dobson, Natchitoches, Louisiana

## YMCA in good shape with Koppers laminated wood

When the late John Guy Marker of Wight and Company Inc. planned the Indian Boundary YMCA in Downers Grove, Illinois, he faced two major design considerations. He needed a building material that would blend naturally with the site, a 17-acre rolling meadow. And he wanted a low slung Y-shaped silhouette that would not overpower the surrounding environment of single family homes. Koppers wood building products filled the bill. For the structural wall and roof framing in the natatorium, club rooms, and future gym, Mr. Marker specified prefinished Koppers laminated wood beams. Varying in depth from two to six feet, the beams range in span from 40 to 75 feet.

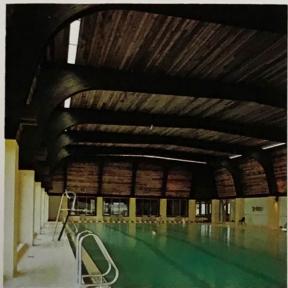
Wall and roof decking is three inch laminated cedar tongue and groove planking nailed directly to the laminated beams. The decking spans the 15-foot spacing between the beams without support from any additional framing members. The natural beauty of laminated decking is exposed on all interior surfaces. On the outside, it is shingled over with Koppers Class "C" pressure-treated hand-split red cedar shakes. With its low coefficient of expansion and contraction in changing moisture conditions, plus high impermeability to liquids, Cedar offers exceptional durability and weather resistance.

Architect: Wight and Company, Inc., Downers Grove, III.











Ecology is a touchy subject, especially in the vicinity of a sewage treatment plant.

For this and comparable troublemaker environments, a large treated wood dome can effectively put the lid on the problem.

At the Hudson, Wisconsin, sewage treatment plant, a wood dome has covered the 69-foot diameter trickling filter since 1960. It reduces odors, improves efficiency, and pre-

vents the scattering of wind-driven vapors and spray over adjacent properties.

Raised six inches from the perimeter of the filter, the dome permits necessary air flow in from the sides and up through a vent at top center. Still, the covering prevents freezing in moderately cold weather. At extreme low temperatures, sideboards can be inserted in the sixinch opening to keep the filter from

freezing.

Prompted by the success of this installation, Koppers has designed all-wood dome systems to cover a variety of similar facilities.

The Koppers design uses laminated wood arches and timber purlins as structurals and plywood for roof decking. All laminates and decking are Cellon® treated to resist weather, insect attack, and moisture-induced decay.

Koppers Company, Inc. Pittsburgh, Pa. 15219

## KOPPERS

Architectural and Construction Materials



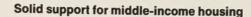
piling piling



Support the college of your choice—or the marina, apartment building, shopping center, plant, or residence—on pressure-treated timber piling. Design loads of 50 tons per pile are becoming common. Life expectancy is estimated at a hundred years. And the in-place cost of pressure-treated timber piling frequently saves \$1 per foot over other pile material. Here are some examples of how the combination of timber and pressure treatment is being used to lay good foundations.









## Building at the beach

Homes are proliferating alo 53,000 mile shoreline of the nental United States.

They're also showing stride imaginative design and in p from the particular forms of high winds, high waves, dar and erosion—that seaside h must withstand.

In 1962, designer-builder R. Coakley saw a hurricane de many Virginia shore vacatic as storm waves battered the and churned sand from ben slabs, often collapsing the k So when Mr. Coakley's firm bridge Enterprises, Inc., be develop the nine mile stretc bridge Beach, the new hom designed to stand on creospiling.

The average structure at Sa takes about 20 piles. Theorone pile would support the The number is dictated by f beam arrangements, lateral and wind loads. Thirty-foot are driven to a depth of abc feet, leaving a 10-foot-plus clearance. House designs a tangular, but roof overhang and unequal legs help to gi illusionary deviation from 9 angle walls.



Utility cores are suspended floor beams, in some cases inside stairways for access the Sandbridge houses hav stairways, and many have c to exposed sundecks, all st on piles, for an unobstructe oramic view of sea and bea

One of the largest housing complexes ever planned, Co-op City in the Bronx will have a population of 15,300 families or roughly 60,000 people.

Thirty thousand wood piles, 20 to 75 feet long, were used for foundation support of shopping centers, town houses, and utility distribution buildings.

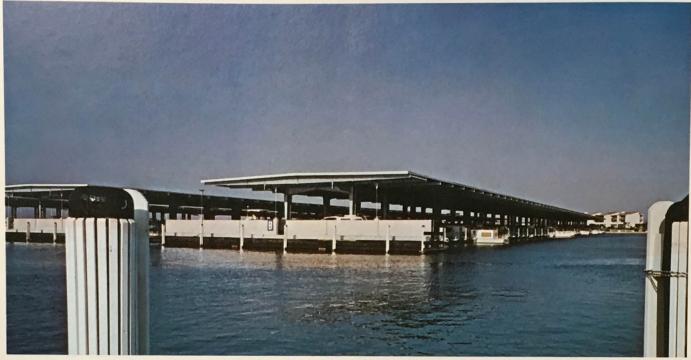
Included in the big middle-income housing project are 35 fireproof residential buildings, each 24 to 33 stories high, plus 236 town houses, 8 six-story garages, power plant, shopping centers, and schools.

Wood foundation piling, driven to support design loads of 20-ton and 25-ton capacities, were treated by Koppers with creosote to resist underground decay.

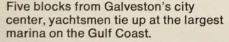












The Galveston Yacht Basin boasts 450 covered berths, dry boat storage for 180 boats, and 150 sailboat slips. Four large, roofed piers run parallel from the shore toward Galveston



Channel, each sheltering from 46 to 116 boats, with private walk-in lockers for each.

Electric carts carry boat owners from parking areas to docking berths and to other facilities, including such uncommon dockside amenities as air-conditioned restrooms.

The main piers plus several open



docks, fuel dock, and shoreline structures are all supported by wood piling, creosote-treated by Koppers to provide many years of maintenance-free service.

Above-water portions of the piles are clad in white painted wood batting to protect boat finishes and tie-ropes.

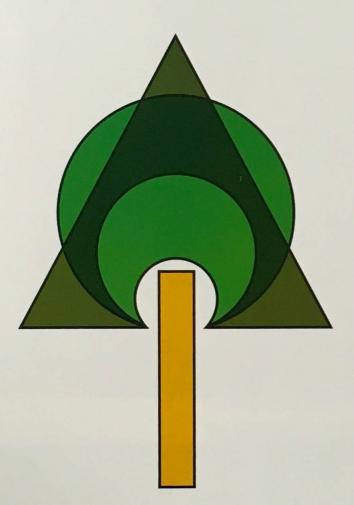
Koppers Company, Inc. Pittsburgh, Pa. 15219

KOPPERS Architectural and

**Construction Materials** 

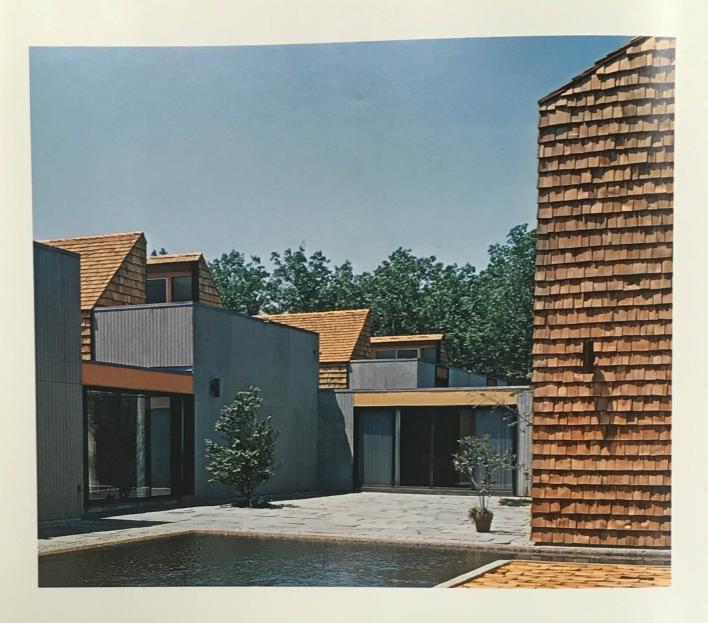






Timber. Sturdy, rich, natural, rustic, elegant. Texture, warmth, character. Few building materials can approach the permanence and beauty of treated wood: exposed timber structurals, rustic red cedar shakes and shingles, rich wood interiors, exteriors, and decking.

When Koppers treats wood to resist fire, rot, or infestation, the wood retains its beauty and its workability. Nothing is added but permanence.

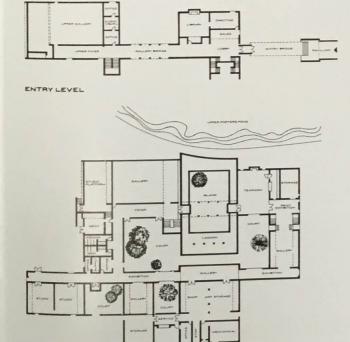






#### Red cedar shakes perform a work of art

Cast in a sylvan setting of woods and water, the Brockton, Massachusetts Art Center combines man's finest art with the beauty of nature. The Brockton Center is an unusual cultural building, constructed of exposed wood plank and sandblasted salvaged mill beams on wood post and bearing walls. The architect extended the wood theme to the exterior of the building with Koppers fire-retardant red cedar shakes for the roof, and untreated shakes for the exterior walls. The roof shakes-24" long, tapered from 1/2" to 3/4"-were pressure impregnated with fire-retardant chemicals which remain fixed in the wood. They have a Class "C" fire rating from Underwriters' Laboratories, Inc. The natural color is not affected by the chemical treatment, so there are no color variations between the treated and untreated shakes. In addition to their natural beauty, the shakes are weather-proof and wind-resistant.



Architect: J. Timothy Anderson & Associates, Inc. Boston, Mass.

GROUND LEVEL

#### Fire protection on the side

Rough sawn board and batten cedar siding adds a touch of Olde England to the character of the Charter Oak townhouse and apartment development in St. Louis. The natural wood texture also blends in with the total visual environment of this 280-unit complex. Charter Oak is replete with gardens, terraces, and rustic balconies and situated on 43 acres of natural sloping terrain where hundreds of oak trees have been left standing.

What *isn't* natural about the wood is its fire resistance. It is now better protected against fire and the elements than it ever was in the forest.

Plywood siding for Charter Oak was treated by Koppers with fire retardant and weather resistant chemicals. It is unchanged from its natural appearance but will not support flame.

Non-Com® fire retardant wood products are available for both interior and exterior uses, including fire retardant red cedar shakes and shingles for roofing and siding.

Non-Com materials carry the Underwriters' Laboratories, Inc. "FR-S" label, the highest grading for fire retardant materials. Fire retardant shakes and shingles carry UL Class "B" and "C" ratings for roofing materials.

Architects: Hastings and Chivetta, St. Louis and Dale Seltzer, Dallas

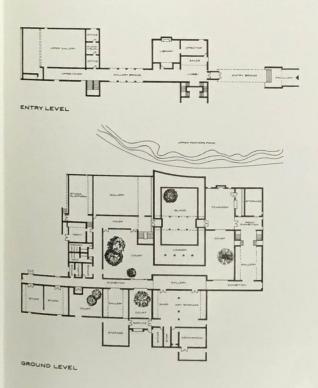






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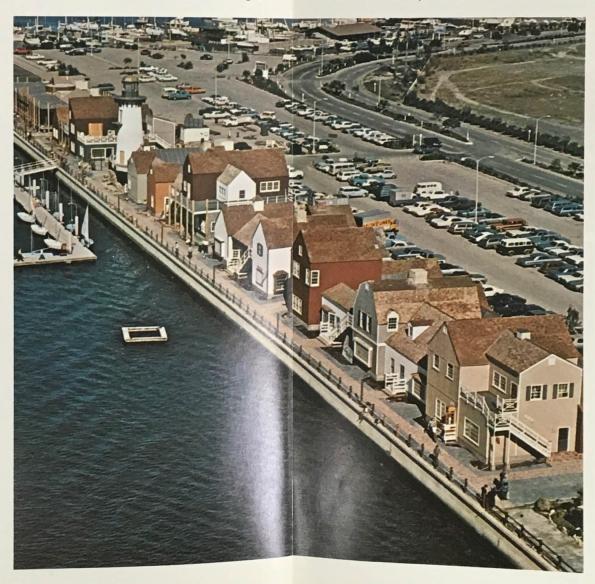
Architect: J. Timothy Anderson & Associates, Inc. Boston, Mass,

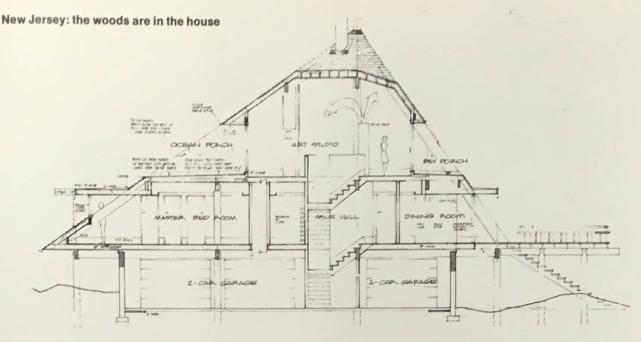
## Cape Cod (California)

Marina del Rey, California, is the world's largest small-craft harbor. It's also one of the most charming. Marina del Rey Enterprises, Inc., a private investing firm, has completed a new shopping complex on the Marina del Rey waterfront called Fisherman's Village. Each building, including a 60-foot lighthouse, is styled after authentic Cape Cod shoreline structures. In keeping with true Cape Cod architecture, the colorful buildings at Fisherman's Village are made of wood. The 25,000 square feet of Western Red Cedar roof shingles

ordinarily could not have met fire protection code requirements. But these shingles were pressure-treated with fire retardant chemicals under a method developed by Koppers Company. The treated shingles carry an Underwriters' Laboratories, Inc. Class "C" rating for prepared roof covering materials. Basically non-soluble in water, the chemicals will not leach out under rain and weathering conditions.

Designer & Builder: Sheldon L. Pollack Corporation





Chalk up one stretch of New Jersey barrier beach on the way back from ecological ruin and aesthetic disgrace.

Fronting the ocean on picturesque Long Beach Island, the site had long ago lost its forest, topsoil, and wildlife to beach erosion and bull-dozers. Now thousands of new plantings and dune-building grasses are beginning to grow, interlaced and protected by natural wood walkways.

Centering the scene is an unusual home—a five-sided pyramid of rustic weathered wood, designed by architect Malcolm Wells for the James H. Duncan family.

Design theme for the house is totally one of blending a structure with its natural surroundings. As seen from

seaside, the long slant of the pyramid roofline picks up the slope of a dune and carries it skyward. And in the same spirit, construction materials were chosen for natural tones and textures that would "harmonize and weather gracefully together." Wood, pressure treated by Koppers to withstand the damaging effects of an ocean front environment, is the main construction material. Copper flashing and bronze hardware complement the wood.

The house stands on pressurecreosoted wood piles, as storm waves pass harmlessly underneath. Its framework is dark stained laminated wood beams joined by metal plates. Matching round wood columns complete the interior structure, and the roof—which doubles as both roof and walls—is covered with Koppers fire-retardant Class "C" red cedar shingles. Exterior wood decking and slatted outdoor walkways are built of wood treated with the Wolman® process, which protects wood from decay and rot, yet leaves its surface dry and natural in appearance. Even with dunes and new plantings protected from erosion, says Mr. Wells, it will take time for a full complement of grass, shrubs and trees to grow back on this oncewooded site.

In the meantime, there are beautiful woods in the house.

Architect: Malcolm B. Wells, Cherry Hill, N.J.







Koppers Company, Inc.
Pittsburgh, Pa. 15219

OPPERS

Architectural and
Construction Materials



#### As big as all outdoors

For the Kentucky state park system's newest recreational lodge, Edward Durell Stone combined massive wood columns and beams with expansive lakeview windows and achieved an exhilarating interchange of indoor and outdoor atmospheres

Located on Lake Barkley near Cadiz, the Lodge centers a curved waterfront extending out into the lake. Original designs were prepared by Mr. Stone, with Lee Potter Smith & Associates, serving as associate architects and supervisors of construction. The main lodge building is a three-floor Patriarchal cross shaped plan with extreme arm dimensions of more than 200 feet at the upper level. On the second floor is a

5,400 square foot dining/meeting area. The 8,200 square foot bottom level has a coffee shop, lounge, and activity areas, plus a terrace overlooking a swimming pool and the lake

Intricately joined timber columns, roof beams, and wood roof decking soar to a height of 54 feet and blend with the timbered countryside surrounding the lodge. The "outdoor-indoor" effect is achieved with huge wood pillars and beams supporting an exposed roof deck, enormous fireplaces, and wall-sized windows looking out on Lake Barkley and the surrounding trees and lawns. From the outside there is the feeling of being inside; from the inside, a rustic impression of being outdoors. Over 700,000 board feet of Cellon®

treated lumber from Koppers Company give the structure the warm, rustic effect of natural wood. In the Cellon process, Koppers pressure-impregnates the wood with pentachlorophenol in the form of a dry, leach-resistant crystalline salt to fully protect it against decay, insect attack, and exposure to weather.

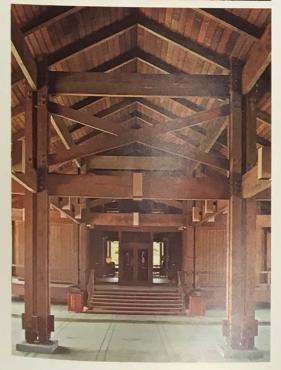
Koppers also makes fire-resistant Non-Com® wood, fire retardant red cedar shakes and shingles, and Wolmanized® lumber that resists rot, decay, and termites.

Architect: Edward Durell Stone & Associates, New York, N.Y. Associate Architect: Lee Potter Smith & Associates, Paducah, Ky.







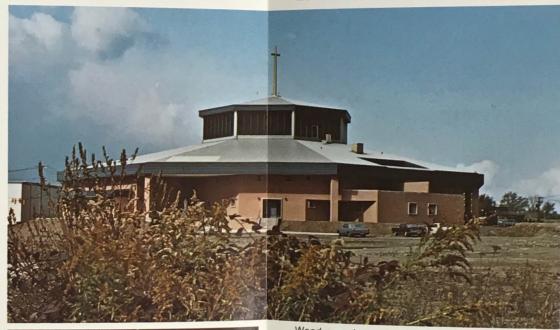


# Keeping it all under one roof

Church, offices, and rectory, all under one roof. That was the plan for the new St. Thomas More Church in Bethel Park, Pa. A single, column-free octagonal structure houses all church and related facilities, eliminating the need for multiple buildings with duplicative systems for any important control and computations. tems for environmental control and communications. One problem: for safety's sake, and to meet state building code requirements, the public and private sections of the building had to be divided by a twohour fire separation.

They did it with wood.

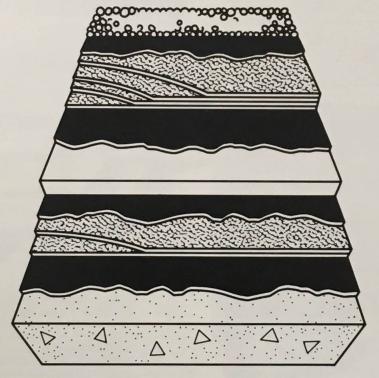
A large fire wall behind the altar is constructed of Non-Com® fire retardant wood studding and vinyl covered drywall. Non-Com wood is acceptable under Pennsylvania building regulations for use in fireproof, fire-resistive, and incombustible buildings.





Wood was chosen as lighter and less expensive than a masonry system for the fire wall, which is 26 feet high at one point. Non-Com® fire retardant wood was also used for all ceiling joists and wall studding in the rectory and the church offices.

Architect: James M. Scarlett and Associate



The roof needs pitch—if not geometrical pitch, then coal tar pitch, in a built-up roofing system that will seal out moisture for decades to come. Waterproofing and built-up roofing are Koppers specialties. Many buildings have Koppers membrane roofing and waterproofing systems that are still in good shape, still sealing out water and water vapor, after thirty and forty years of service. Here are several newer ones.

#### Waterproofing for a treasure house

Florida has a new State Museum, built to preserve things worth preserving—and waterproofed to preserve the museum itself, along with its ancient treasures.

Built at the University of Florida in Gainesville, the new museum is the largest natural history showplace in the South: an L-shaped structure on three levels, following the contours of a southerly slope in a series of earth berms and terraces. Appropriately, ground was broken with a 2,000 year old stone spade unearthed in a Seminole Indian mound.

The structure includes 104,000

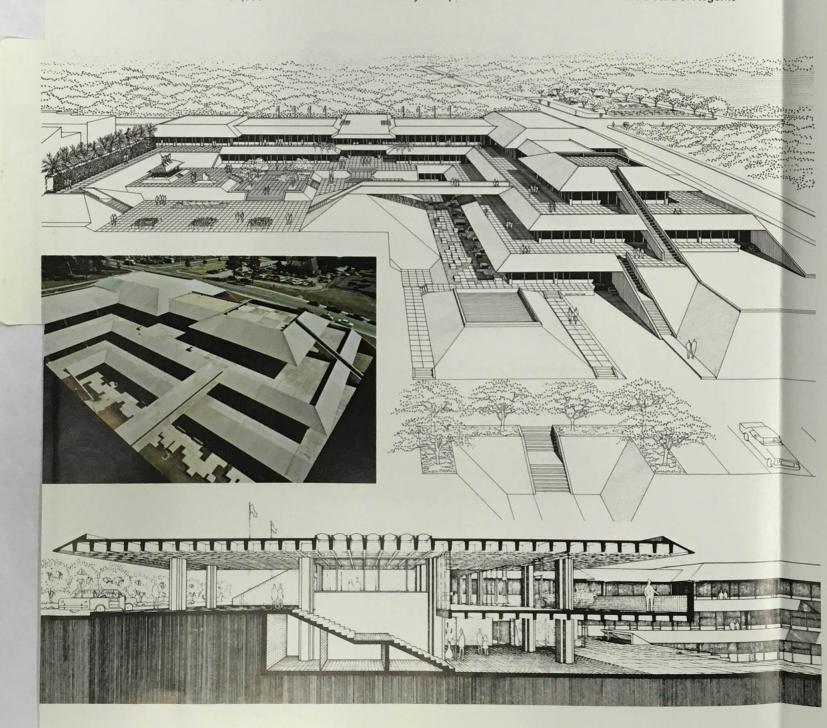
square feet of air conditioned space for offices, research facilities, and exhibits including Indian artifacts that predate Columbus and fossils that predate man.

Just as fossils are often preserved in the ground by coal tar pitch, the new Museum is protected throughout by coal tar pitch waterproofing systems from Koppers.

More than 17.8 million square feet of materials guard against moisture penetration. Koppers tar-saturated two-ply membrane system was used on the foundation and as a sandwich layer between it and precast surface slabs. The same system protects all

vertical walls below ground level and, accompanied by one inch rigid insulation board, under traffic decks. A four-ply built-up coal tar membrane roofing system was used over concrete and metal deck areas, with a five-ply system under the deck of a rooftop vivarium. Check the coupon for information on Koppers built-up roofing and waterproofing systems.

Architects: William Morgan, AIA, Jacksonville, Florida in association with Forrest Kelley, AIA, Florida Board of Regents



# McCormick Place: two major facilities under one wa



Chicago's new McCormick Place is an \$83 million convention and exhibition center built on the same lakefront site where fire destroyed old McCormick Place in January of 1967.

It has 600,000 square feet of exhibit space, including a 302,000 square foot main exhibit area with a uniform ceiling height of 50 feet. Beneath this hall are two levels of exhibition and meeting rooms, designed to utilize parts of the original structure left intact after the fire.

A second building houses a 4,451 seat theater along with restaurants and additional meeting rooms.

A single roof covers the two buildings. Cantilevered at the perimeter, it provides a 74-foot overhang for weather protection of pedestrian and vehicle passages and dock loading areas. Between the two structures is a broad, covered pedestrian mall.

For permanent weather protection, the roof has 800,000 square feet of Koppers built-up roofing, using alternate layers of coal tar pitch and tar-saturated felt and two layers of glass fiber insulation.

Coal tar pitch is permanently resistant to water or vapor penetration, chemical or bacterial attack, and to oxidation.

Architect: C. F. Murphy Associates

### "New Roof" at one tenth the cost

It looked like a million dollar roofing job. It turned out to be a tenth of that.

When the roof started to leak at Cleveland's City Hall, city officials faced a major problem and, apparently, a major expense. To retain the design and character of the building—with prominent mansards, fascias, skylights, and penthouse, all sheathed in copper—was going to require huge quantities of new metal and extensive forming.

Instead, they used custom-applied roof maintenance systems, including a weathered-copper color coating, supplied by Koppers.

The roof was still sound but pitted with pinholes from a half century of atmospheric exposure. Over this, they applied Roofshield® asphalt emulsion and glass fabric, topcoated with Colorshield®, latex-based coating in weathered-copper color.

Built-in gutters, batten seams, and ornamental ridges were fitted with special cuts of heavy duty glass mesh and hand-brushed with the emulsion.

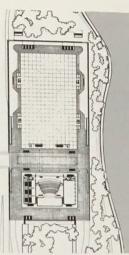
On flat areas of the main roof, a coal tar resaturant revived the existing roof. This material has a base of coal tar roofing pitch, blended with non-volatile penetrating oils and asbestos fibers. It restores hardened roofing pitch to its original condition and provides adhesive for a covering of gravel.



Architect/Engineer: Madison, Madison International

McCormick Place: two major facilities under one watertight roof.





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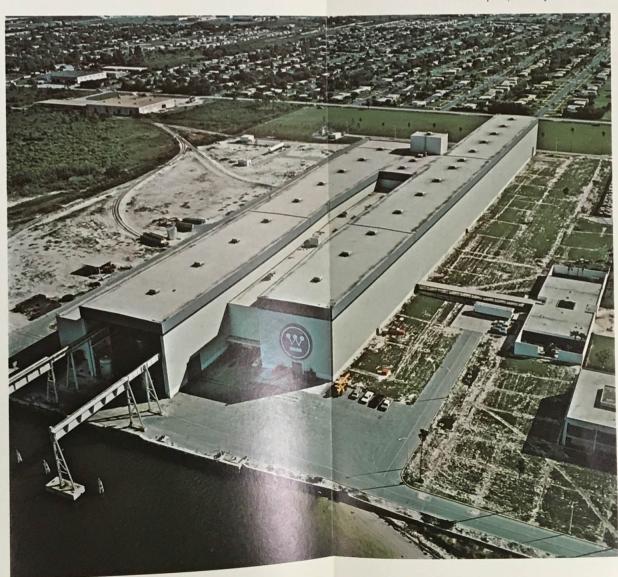
Architect: C. F. Murphy Associates

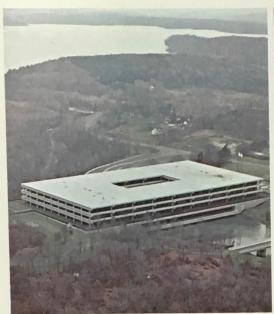
#### Westinghouse tops a winner with Koppers built-up roofing

The new Westinghouse nuclear products plant in Tampa, Florida, was selected as one of the top ten plants of 1968 by Modern Manufacturing magazine. Situated on a 55-acre tract west of Tampa Bay, the 80-foot high, 1,000-foot long plant has an adjacent office building, mall, employee center, and parking area. Topping out the award-winning complex is 250,000 square feet of 4-ply Koppers built-up roofing. On the steel roof deck, a one-inch thick layer of rigid insulation was embedded in a mopping of steep asphalt. Then came four alternating layers of coal tar pitch and tarred felt. This was followed by a heavy pouring of coal tar pitch. A top layer of aggregate was then embedded in the pitch.

Coal tar pitch provides one of the most durable roofing and waterproofing membranes known. The tight molecular structure permanently resists oxidation of the roof surface and penetration of water and water vapor. Koppers built-up coal tar pitch roofs have endured for more than thirty-five years on many buildings and are still in excellent condition.

Architect-Engineer: The Kuljian Corporation Philadelphia, Pennsylvania











Standing astride a deep ravine, the new headquarters building for American Can Company at Greenwich, Connecticut, is situated on 181 acres of woodlands, natural rock outcroppings and a bird and animal sanctuary. For the 1,800 employees who occupy the building, this natural setting has been preserved and enhanced. At the same time, architects Skidmore, Owings & Merrill had to be sure that nature was kept in her place.

Some 443,000 square feet of Koppers built-up roofing and waterproofing

seal this showcase structure from rain, snow, and ice. Roofing for the main building and executive wing carries the protection of two-inch insulation board covered with a 43-pound base sheet vapor barrier. It is then topped with a base sheet and three plies of pitch and tarred felt roofing and finished with crystal spar gravel. Overhanging walkways are laid with 46,000 square feet of five-ply pitch and felt waterproofing. Plazas, courts, terraces, and planters are all protected by multiple-ply felt and pitch membrane waterproofing,

combined with insulating material where appropriate. All told, over ten acres of roofing and waterproofing seal this unusual corporate headquarters.

Koppers built-up roofing and waterproofing employ the remarkable properties of coal tar pitch to resist oxidation and vapor penetration for dozens of years.

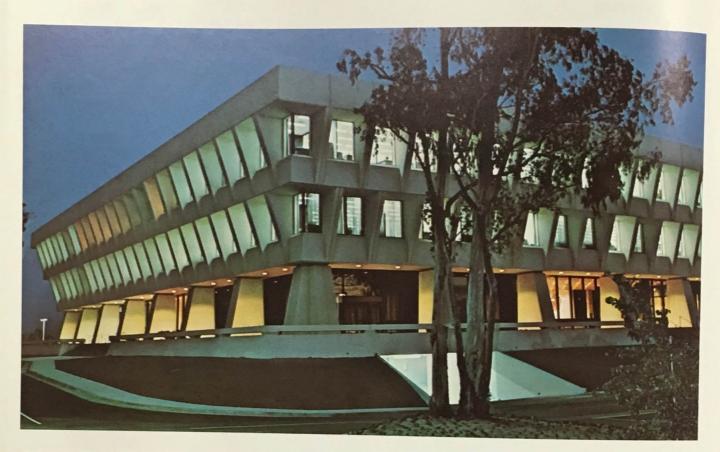
Architect: Skidmore, Owings & Merrill, New York, N.Y.

Koppers Company, Inc. Pittsburgh, Pa. 15219

# **KOPPERS**

Architectural and Construction Materials







The new International Headquarters of Sunkist Growers, Inc., is a low-profile cantilevered structure whose exterior walls slope outward as they rise.

One of the oldest and largest farmer cooperatives, Sunkist serves 8,000 grower members who market 70 percent of the fresh citrus shipments of California and Arizona. Their new headquarters contains 141,000 square feet of usable floor space on an 8.5 acre site in Sherman Oaks, suburban Los Angeles.

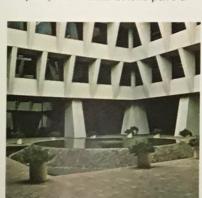
Designed by Albert C. Martin & Associates, the building resembles an inverted pyramid in profile, its walls sloping outward 15 feet as they rise 49 feet above the ground. Windows are deeply recessed and vertical.

The building is quadrangular in floor plan, enclosing an open inner court with a large reflecting pool. Walls facing the court have the same slant as the outside walls.

The main pool is circular and raised. Its water flows constantly outward, trickling over banks of Mexican beach pebbles into four corner pools. Deep red brick paving, set flush to the foundation, surrounds this pool, and similar bricks pave a

promenade around th perimeter of the build Beneath the pool are other facilities. This, to prevent seepage o from the promenade basement, indicated attention to the buildi waterproofing system In both critical areas, a multiple ply membr type of waterproofing alternate layers of co between layers of tar fabric or felt, to form impermeable seal. In the pool and sealed ti building foundation, t protects the lower lev water should puddle court or promenade c Topping off the prote Koppers coal tar pitc felt built-up roof, with this membrane under roof slabs on which a equipment rests. The surface has an additicoal tar pitch with ag surfacing.

Architect: Albert C. N





The new Ordway Building in Kaiser Center, Oakland, has all around weather and water protection, from the roof right down to planter boxes in the plaza. Over 21,000 square feet of four-ply Koppers built-up roofing tops the building. Alternate layers of coal tar pitch and tarred felt furnish a durable, maintenancefree seal, with a layer of insulation in between. Exterior walls have a five-ply Koppers waterproofing system of tarred membrane and pitch, and the plaza and planter box area is protected from weather and seepage by a four-ply waterproofing system. Coal tar pitch is chemically inert, resistant to bacteria, and unaffected by water, even under prolonged immersion. Its tight molecular structure is permanently resistant not only to water penetration but to the degrading effects of intense sunlight, and it heals itself in case of small cracks.

Architect: Skidmore, Owings and Merrill



# Waterproofing for an "inverted pyramid"

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promenade around the outside perimeter of the building.

Beneath the pool are parking and other facilities. This, plus the need to prevent seepage of rainwater from the promenade deck into the basement, indicated special attention to the building's waterproofing system.

In both critical areas, the choice was a multiple ply membrane system: a type of waterproofing that uses alternate layers of coal tar pitch between layers of tar-saturated fabric or felt, to form a tight, impermeable seal. Installed beneath the pool and sealed tightly to the building foundation, this membrane protects the lower level even if water should puddle on the inner court or promenade deck.

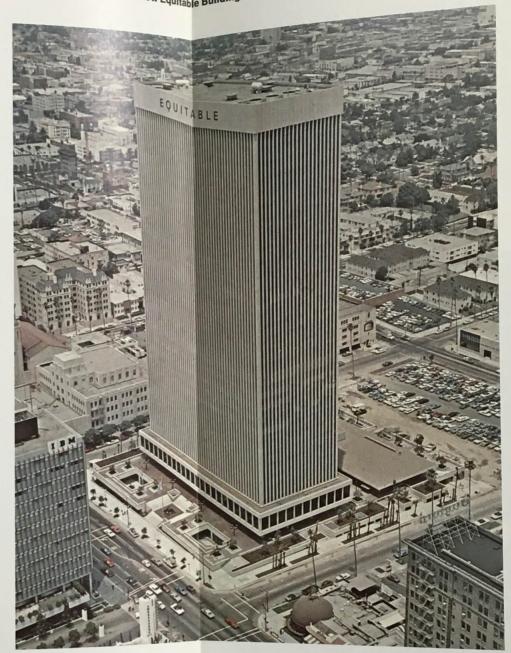
Topping off the protection is a Koppers coal tar pitch and tarred felt built-up roof, with extra plies of this membrane under the concrete roof slabs on which air conditioning equipment rests. The entire roof surface has an additional pouring of coal tar pitch with aggregate surfacing.

Architect: Albert C. Martin & Associates





# Weather insurance for the new Equitable Building



The Southern California head-quarters building of the Equitable Life Assurance Society is the tallest structure on Los Angeles' Wilshire Boulevard. It towers 34 stories from a 2½-acre landscaped plaza and retail shopping area. The building's height is accentuated by projecting fins of precast beige concrete embedded with Texas limestone aggregate.

For the best long-term water protection, Koppers multiple-ply coal tar pitch and felt waterproofing and roofing was used for the roofing, plaza, planters, and planter walls: Built-Up Roofing: 55,000 sq. ft.

of 4-ply pitch and felt topped with aggregate embedded in hot pitch. Plaza: 64,000 sq. ft. of 5-ply pitch and felt topped with tile set in mortar. Planters: 16,000 sq. ft. of 4-ply pitch and felt.

Planter Walls: 3-ply pitch and felt. Coal tar pitch provides one of the most durable roofing and water-proofing membranes known. The tight molecular structure permanently resists oxidation of the roof surface and penetration of water and water vapor.

Architect: Welton Becket & Associates

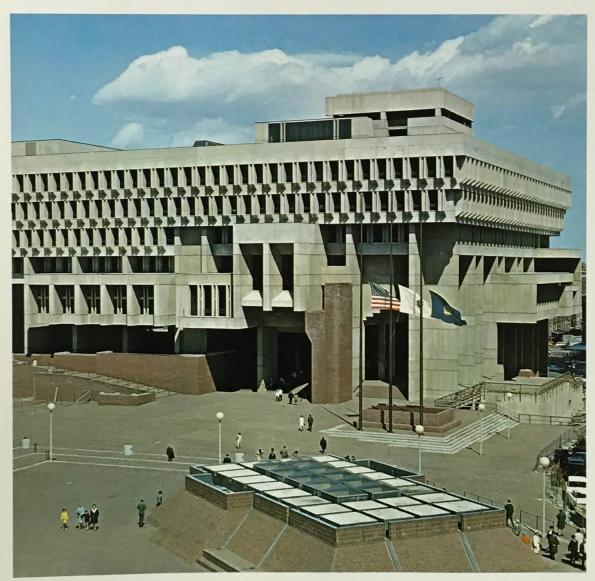
The new Boston City Hall was decided upon in 1962 when the architects won a national competition with their idea of just what a city hall should be. It is now a concrete and brick example of architectural achievement.

The organization of the building is complex but open—visitors can pass through their City Hall any time of the day or night and not be confronted by a single door. Erected on a sloping site, the lower floors are partially buried and include garage space, files, computer rooms

and offices. The second and third floors hold those government offices most contacted by the public. The top four floors contain office spaces requiring a minimum of public traffic, and hung below them at the fifth level are the elements of symbolic and civic importance: the Mayor's Suite and the City Council Chambers. The roof of City Hall is a 74,000 square foot, 4-ply Koppers roof. On the concrete deck, a vapor barrier of one-ply tarred felt was laid, then 1½" ridged insulation board. Next came alternate layers of coal tar

pitch and tar-saturated felts with a final heavy top pouring of coal tar pitch with aggregate embedded. The molecular structure of coal tar pitch provides long-term water-proofing. Many Koppers built-up coal tar pitch roofs are more than thirty-five years old and still in excellent condition.

Architects and Engineers for the Boston City Hall: Kallmann, McKinnell & Knowles Campbell, Aldrich & Nulty Le Messurier Associates, Inc.



Koppers Company, Inc. Pittsburgh, Pa. 15219

**KOPPERS** 

Architectural and Construction Materials

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If you do not see a publication that seems to fit your specific interest, simply use one of the blank spaces on a reply card to write in the product or application for which you want information.

If you prefer to have a Koppers representative call, call the nearest Koppers sales office, listed in this folder.

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- 3 Penacolite® Resorcinol Adhesives for Permanent, Waterproof Bonding



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- 11 Questions and Answers on Non-Com® Fire Protected Wood
- 12 Cellon® Pressure-Treated Lumber

# **37**

MOISTURE PROTECTION

waterproofing—dampproofing membrane roofing

- 13 Penacolite® Resorcinol Adhesives for Permanent, Waterproof Bonding
- 14 Built-up Roofing
- 15 Waterproofing and Dampproofing
- 16 Reinforcement Fabrics: a look at membranes



- 17 Polyester Flooring: tough, beautiful and it goes anywhere
- 18 Polyester Thinset Terrazzo For Durability, Low Maintenance, Beauty, Design Flexibility



- 19 Corrosion control, inside and out
- 20 Koppers protective coatings (oil, gas, water and electricity: anywhere these flow)

# PROBLEMS AND LOW-COST SOLUTIONS



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- 21 Acoustilouvre®
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other solutions

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Problems	Low-cost Koppers solutions
Builf-up roofing	Reinforcement fabrics, coal tar roofing pitch, system roofs
Waterproofing	Reinforcement fabrics, coal tar pitch, coal tar waterproofing pitch, cold applied applications
Dampproofing	Same as waterproofing, plus Durethene® polyethylene film
Corrosion protection for steel	Bituminous coatings, synthetic resin coatings
Corrosion protection—concrete & masonry	Bituminous coatings, synthetic resin coatings, coal tar water-proofing pitch
Protection of asphalt pavement	Pavement sealers
Insulation	Dylite® foam plastic board
Low-cost piling, poles and structures	Pressure-creosoted wood
Fire protection for wood	Non-Com® wood, Class "B" & "C" Cedar shakes & shingles, Non-Com Exterior
Termite, rot and decay protection	Pressure-creosoted wood, Cellon® pressure-treated wood, Wolmanized® lumber
Sound control	Aircoustat® sound traps, Acoustilouvres® Soundmetal® panels
Adhesive for wood	Penacolite® adhesives
Structural systems	Laminated arches, beams, decking
Environmental control	Aircoustat sound traps, Acousti- louvres Soundmetal panels, electrostatic precipitators, water and waste treatment equipment
Polyester terrazzo	Markay® decorative thin set polyester terrazzo; Color-Tuff



polyester monolithic flooring

flooring

Architectural and Construction Materials

Koppers Company, Inc.
Pittsburgh, Pa. 15219

KOPPERS

Architectural and
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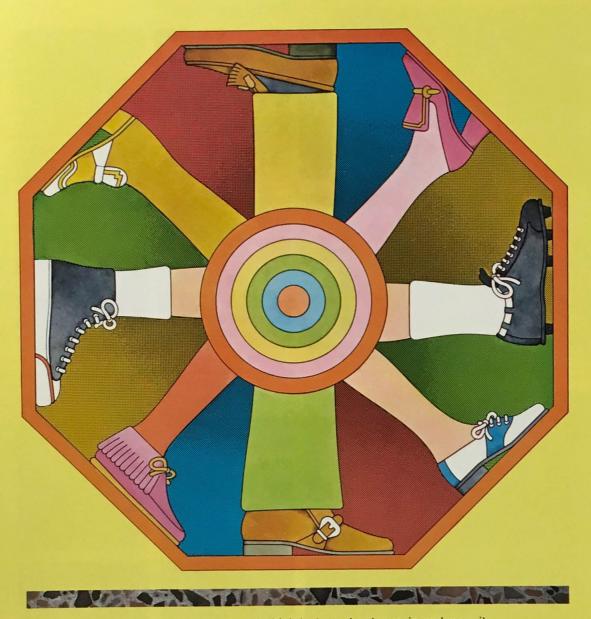
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**DESIGN IDEAS KOPPERS** 

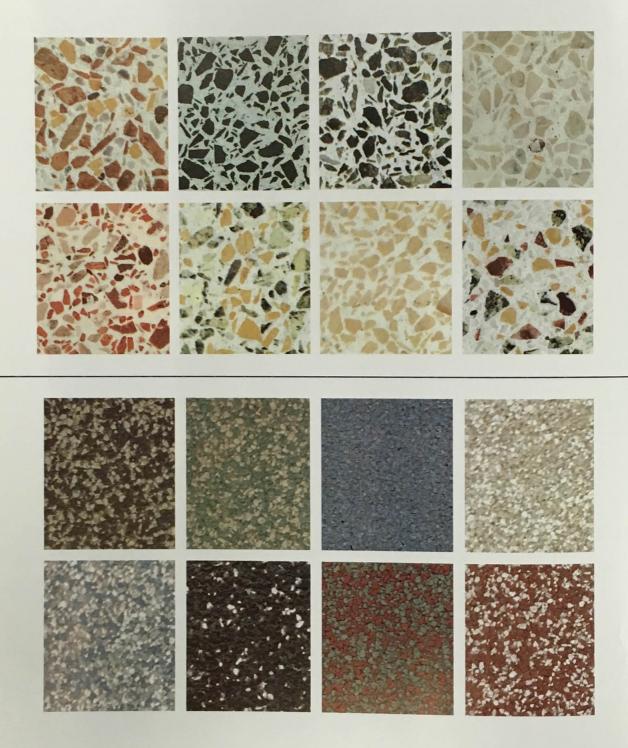


Put colorful marble chips in high-luster polyester resin and pour it like cement. It looks like terrazzo, only better. It lasts like terrazzo, but shows less wear. Best of all, it's seventy to ninety-four percent thinner than terrazzo, so it saves weight and lowers costs. That's Koppers Thin-set flooring. Note some of its recent uses.





#### Terrazzo



**Topping** 

#### pouring the floor

# Thin-set polyester systems earn increasing floorspace

No one wants flooring reminiscent of an industrial plant—not even in the plant. So where floors have to take an exceptional beating, there is increasing use of new thin-set flooring systems that are not only super-tough and stain resistant but are beautiful in their own right.

Two systems show particular promise. One is a hard, thin-set terrazzo system using a polyester matrix, sometimes incorporating a special chemical resistant formula. The other is a poured floor topping of polyester resin filled with ceramic coated quartz aggregate and selected minerals. Both systems are attractive, durable, and exceptionally easy to clean and maintain. Many architects feel that the terrazzo system has the aesthetic edge. It is also the last word in ease of maintenance. The polyester topping system is slightly more rugged and more economical on an original cost

Beyond that, generalizations are hard to come by. Koppers has supplied thin-set polyester systems for applications that vary all the way from commercial and industrial buildings to retail showrooms, banks, hotels, scientific and educational structures, and even private homes.

#### Terrazzo sy:

The most obvious attr polyester terrazzo flo beautiful-in a wide ra color, texture, and pa determined by the siz mix of aggregate as s architect and by the t and polishing specifie Its practical advantag impressive. The hard. polished surface of po can take rough use, h heels, spills, grease, c burns without scarring They can be waxed, b stripping are not reall Normal washing and r them clean, and the fl good patina for many There is also a weight Compared with the % thickness of convention terrazzo, polyester tei mally ground to 3/16-incan be specified for u floors of high-rise buil cement terrazzo woul load factor.

#### Topping sys

Since polyester resin costly of the many pol available, it makes an medium for poured flc provides the toughnes for heavy traffic or speareas.

Chief aggregate in po topping is quartz, ava sizes and several colc of texture and tone.

These floors are not walmost as easy to cleaterrazzo. They are not proof, highly impact redurable enough for insidewalks, entrancew swimming pools as wareas in schools, host rants, supermarkets, abuildings.





Parke-Davis pharmaceutical plant, Detroit

### Pouring the floor

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#### Terrazzo systems

The most obvious attribute of thin-set polyester terrazzo flooring is that it's beautiful-in a wide ranging variety of color, texture, and pattern. These are determined by the size, colors, and mix of aggregate as selected by the architect and by the type of grinding and polishing specified for installation. Its practical advantages are no less impressive. The hard, non-porous. polished surface of polyester terrazzo can take rough use, heavy loads, spike heels, spills, grease, or cigarette burns without scarring or staining. They can be waxed, but waxing and stripping are not really necessary. Normal washing and mopping keep them clean, and the floors maintain a good patina for many years. There is also a weight advantage. Compared with the 5%-inch to 3-inch

There is also a weight advantage. Compared with the %-inch to 3-inch thickness of conventional cement terrazzo, polyester terrazzo is normally ground to %-inch thickness. It can be specified for use on upper floors of high-rise buildings where cement terrazzo would impose a load factor.

#### **Topping systems**

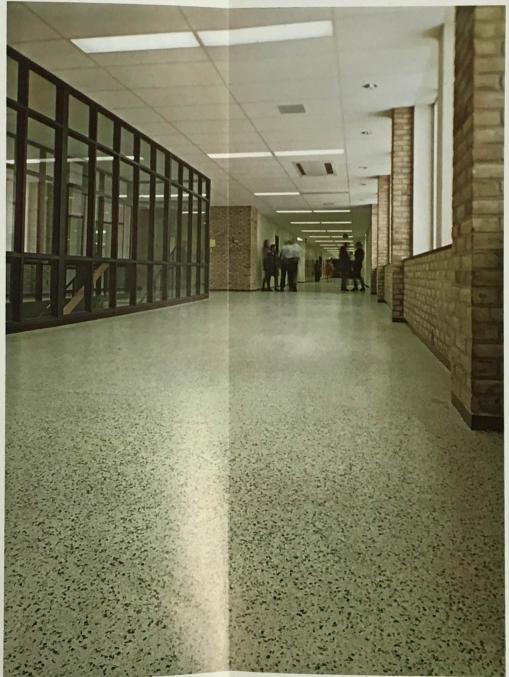
Since polyester resin is the least costly of the many polymer systems available, it makes an economical medium for poured flooring. It also provides the toughness and resiliency for heavy traffic or special-abuse areas.

Chief aggregate in polyester floor topping is quartz, available in two sizes and several colors for a choice of texture and tone.

These floors are not waxed and are almost as easy to clean as polyester terrazzo. They are non-porous, waterproof, highly impact resistant, and durable enough for increasing us 3 on sidewalks, entranceways, and around swimming pools as well as service areas in schools, hospitals, restaurants, supermarkets, and industrial buildings.



Monfort Packing Company, Denver, Colorado



Rochester Middle School, Rochester, Michigan

When architect Curtiss Inscho planned the Medical Basic Science Building at Ohio State University, he decided to try a new flooring material from Koppers on the 30,000 square feet of floor space in the corridors, animal holding and preparation areas. It's called Koppers Decorative Thin-Set Polyester Terrazzo.

Thin-set is a tough, polyester-based matrix filled with marble, granite,

quartz, or other aggregate. It's easier to install and maintain than conventional floors and it comes in virtually any color combination.

Because medical tests are conducted in the animal preparation area, the floors are steam cleaned daily. Polyester Terrazzo's extremely hard surface offers good stain and wear resistance. This is especially important at the entrance to the equipment cleaning chamber where spillage is a constant problem. (See photo center right.)

Another advantage of thin-set is its relatively light weight compared to cement terrazzo. Markay can be ground to a mere  $\frac{4}{16}$  inch thickness resulting in less dead load on the structure—an important consideration in upper floors of high-rise buildings.

Architect: C. Curtiss Inscho & Associates











Koppers Company, Inc.
Pittsburgh, Pa. 15219

KOPPERS

Architectural and
Construction Materials



Protective coatings can be beautiful. Beautiful coatings can be protective. Koppers makes many kinds of coatings, for many uses, some beautiful, some plain, all designed for long-term protection of surfaces or structurals. When the coating is for a pipe line to be buried in the ground, looks don't count and a Koppers Bitumastic® enamel will do the best job in a nice shade of black. But when the coating will be on display, then it's time to consider Koppers coats of many colors. then it's time to consider Koppers coats of many colors.

### New way to make a splash



Swimming pool paints must be protective, but there's nothing to prevent them from being decorative—not when the best protective coatings come in six different colors.

Apparently the idea has considerable appeal for pool owners. When Koppers painted this one as a demonstration, 8,000 people wrote for directions on how to do the same.

The paint is Ramuc® swimming pool enamel, the leader in the field. It comes not only in different colors



but in several types—using chlorinated rubber, vinyl, or epoxy as base—to suit various pool materials and surface conditions.

Aside from time spent on floral designs, Ramuc® paints cost less per year of use than other systems, and they maintain a smooth, tile-like surface that makes the pool easy to clean.









On two sections of recently-installed additions to a natural gas line serving the Southwest and California, more than 5,500 tons of Koppers coatings protect the 30- and 36-inch diameter pipe from corrosion. The line runs 554 miles from the gas producing basins of west Texas through New Mexico and Arizona to the California border with an additional capacity of 310 million cubic feet of gas per day for distribution companies in the Southwest and California. For this job it was Bitumastic® 70-B Primer and Bitumastic 70-B Enamel. These coatings form a tight, long-lasting shield that protects the steel from moisture and soil acids. Special machines apply the coating as the pipe is held in "saddles" at the side of the ditch, and then wrap it with asbestos-felt.

Koppers supplies a complete line of protective coatings for steel, masonry and concrete: epoxy, alkyd, vinyl, chlorinated rubber, zinc rich and coal tar coatings.









#### **Protective Coloration at the Treatment Plant**

If there must be such things as sewage treatment plants, then they might as well look like this. At Daytona Beach, where they built the first contact stabilization plant in the South, colorful Koppers coatings not only brightened the plant's appearance but also solved the multiple corrosion problems of sewage, salt air, intense sunlight, and high humidity. What could have been a community eyesore has become something of a community showcase. Hundreds of visitors each year include not only municipal officials and engineers but also school children. Several coatings systems were chosen for resistance to specific corrosive factors in various areas of the plant, and for compatibility with the types of surfaces to be protected.





Colors were selected both for aesthetic and for functional reasons. Flooring is light gray to prevent reflections and hide stains. Walls are light green, chosen as restful to the eyes. And all piping is color coded, both for visual contrast and for identification. Exposed sewage piping is aqua green, air piping Alaska gray, valve and gate handwheels bright vermillion.

For durable corrosion protection, a system using chlorinated rubber based coatings covers all concrete and exposed galvanized metal surfaces. Interior concrete received a special fungicide treatment of Ramuc® undercoater and a glossy version of the exterior coating to create a tile-like surface.

Exposed galvanized surfaces, such as walkways and handrails in the highly corrosive atmosphere around aeration tanks, have a four-part chlorinated rubber coating system 6.5 mils thick.

Exposed piping has a quick-drying field primer to assure proper bonding and a finish coating of Glamortex®, an alkyd based Koppers coating that oxidizes to form a rugged, resilient film. Wood surfaces are clad in a two-part epoxy ester based system, and a similar combination protects interior metal surfaces in the pump rooms.

First-phase construction:
Southern Gulf Utilities Corp.,
Miami, Florida
Second-phase construction:
Chilton Construction Company,
Dunedin, Florida

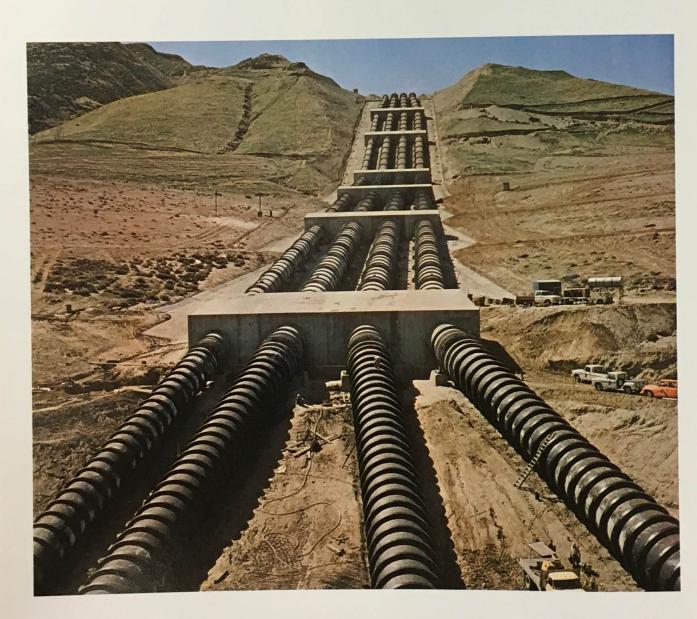
In one spectacular section of the new California Aqueduct, water will leave the Wind Gap pumping station and climb the foothills of a mountain range.

Now nearing completion, the \$25.1 million Wind Gap station will take surplus Northern California water and push it from 725 feet to 1,243 feet above sea level through four mammoth steel pipes at flow rates

up to two million gallons per minute Pipes are nearly 2,000 feet long, three of them with 12.5-foot diameters and the fourth with 9.5 feet. All four rest above ground on massive concrete footings.

Inside and out, the pipes are protected with Koppers coatings systems. Each is lined inside with a coal-tar epoxy coating known as Bitumastic® 300-M, to prevent internal corrosion and provide a glass-like surface for maximum flow

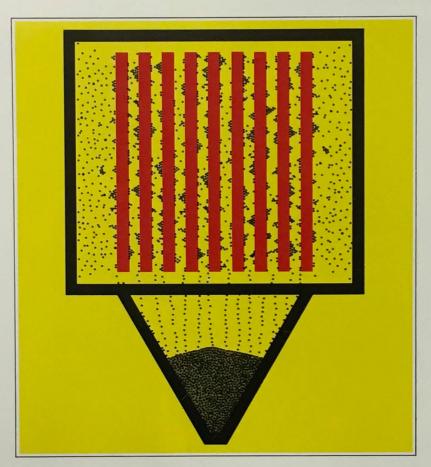
rate. Outside, the pipes and their reinforcing rings have an inorganic zinc coating. Short underground sections where the pipes emerge from the pumping station are clad in a combination of Jet-Set Primer® and Bitumastic 70-B enamel, reinforced with fiber glass and felt.



Koppers Company, Inc. Pittsburgh, Pa. 15219

# KOPPERS

Architectural and Construction Materials



Noise is not a problem until someone hears it. Dirt in its place is topsoil but in the air, it's pollution or dust. In this environment-conscious age, only the architect can solve many dirt and noise problems in advance, before they *become* problems.

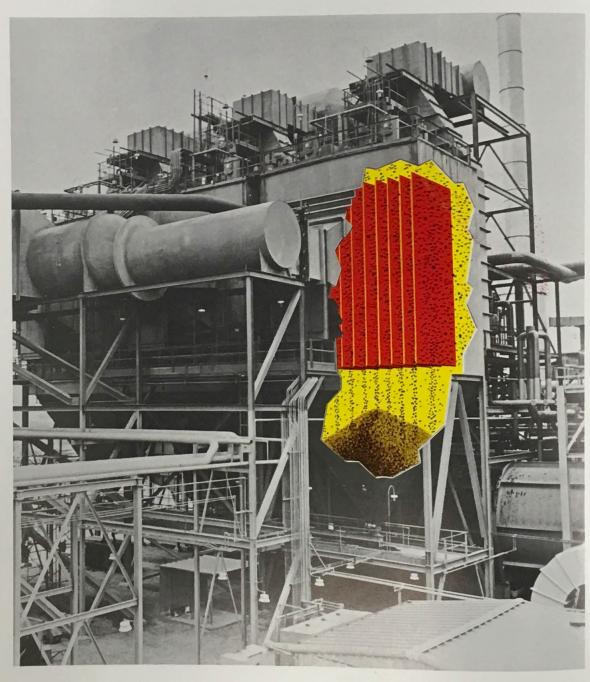
Koppers has important help: a variety of sound conditioning devices and materials, and effective equipment for cleaning the air. Here are a few examples of how architects and engineers are using them.

## Here's one good way to beat air pollution

At this Humble Oil & Refining Company plant in Benicia, California, they made sure they had air pollution problems whipped. They installed three Koppers electrostatic precipitators to remove particles of catalyst and petroleum coke before dust pollution goes up the stack. These units will remove as much as five tons of dust per day . . . dust that would otherwise be blown over the surrounding countryside. Here's how they work: before "smoke" goes up the stack it passes through

the precipitators where all particles of dust (even as small as 1/25,000th of an inch) are given a high-voltage charge of electricity. Large collecting plates, with opposite electrical charges, then draw the charged dust particles and hold them until periodic rapping of the plates deposits the captured dust in collecting bins. Prevention of air and water pollution

and control of sound are among Koppers more important capabilities.



#### Inside story on Environment

The major issue of the day, Environment, has been a concern of architects from the beginning. It all started *inside* the building, and that's where some of the real strides are still being made.

In Honolulu, Phoenix, Salt Lake City, and Los Angeles, for example, new showcase structures are getting extensive built-in provisions to keep offices and meeting rooms not only comfortable but quiet.

The Environmental Control department of Koppers Company, a leader in the field of noise abatement, furnishes Soundmetal® panels to line the walls of machinery rooms and Aircoustat® sound traps for air ducts in buildings such as these:

The new State of Hawaii Capitol in Honolulu (shown here); the \$31 million, 30-story General Church Office Building of the Church of Jesus Christ of Latter Day Saints in Salt Lake City; the entire \$15 million Convention Center complex under construction in downtown Phoenix; and the 19-story, \$32 million Criminal Courts building in the Los Angeles Civic Center.

In these four buildings, approximately 800 sound traps and over 10,000 square feet of sound-absorbing panels will keep the noise of air conditioning equipment from disturbing offices, meetings, trials, and legislative debates.



Koppers Aircoustats have baffles of acoustical material held in place by perforated galvanized steel sheet.
Configurations of the baffles are designed to absorb sound without impeding air flow through ductwork.

Koppers furnishes sound conditioning equipment to silence all sorts of noisemakers—from gas turbine generators (increasingly used for large office buildings) right up to test chambers for the biggest jet engines.

Hawaii Capitol Architects:

Belt, Lemmon & To,

architects and engineers

John Carl Warneke & Associates,

architects and planning consultants

#### **Quiet Please!**

At Burbank, California, the Engine Division of Pacific Airmotive Corporation has built a 1.5 million dollar test cell for maintaining a new breed of giant jet engines, including the supersonic jets of the future. PAC is currently running post-overhaul tests on the Pratt & Whitney JT9D, which powers the Boeing 747. To deaden the tremendous roar generated in the 45,000-pound, maximum thrust tests, Koppers Sound Control Department designed, built, and installed the aerodynamic, thermodynamic, and acoustical systems for PAC's test cell.

The cell contains a series of acoustical baffles, an augmenter, and a diffuser much larger than similar ones designed by Koppers for hundreds of commercial and military test cells. As a part of the PAC sound-suppression system, Koppers also designed a 33-foot-long, 15-foot-diameter steel cylinder containing thousands of two-inch perforations. The cylinder is located in line with the engine exhaust in an 18" thick reinforced concrete exhaust stack rising 60 feet above ground. As the engine blast passes through the perforated cylinder, it is sectionalized, greatly reducing the noise level. Further sound baffling diminishes the noise outside the cell below the normal traffic noise of the area.



In addition to modular component sound conditioning systems like that used in the jet test cell, Koppers also makes a variety of sound conditioning systems and sound traps for commercial and industrial applications.

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### Silence at the power station

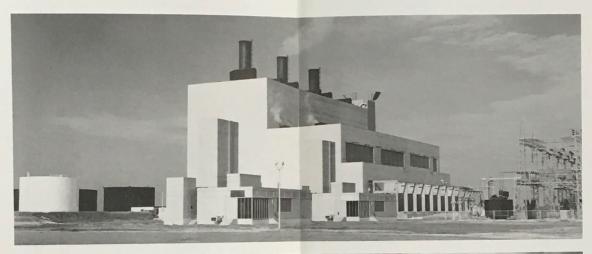
Four hundred feet from a quiet residential section at Avon Park, Florida, a 67,000 kilowatt power generating station goes into action during peak periods of electrical power usage.

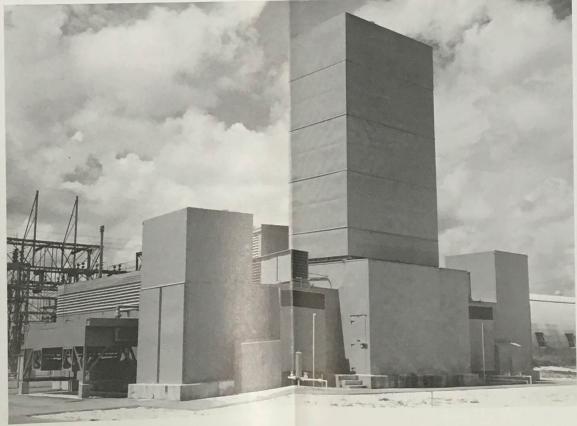
But peace and quiet are not disturbed in nearby homes.

Both for Avon Park and for a similar generating unit at Oldsmar, the Florida Power Corporation built power stations that would do the job quietly.

Both stations are sound-conditioned with acoustical systems from Koppers. To control turbine noise, Florida Power enclosed the turbines in housings of Koppers Soundmetal® panels. These panels are made of sound absorbent material encased in fabricated sections of perforated metal.

Air intake and exhaust systems are also equipped with Koppers silencers, and secondary inlet silencers were installed in cooling ducts.





The New England Telephone Company Administration Building now under construction in Manchester, New Hampshire, has a heating and cooling system that will be the first of its kind in the state. It will also be one of the quietest.

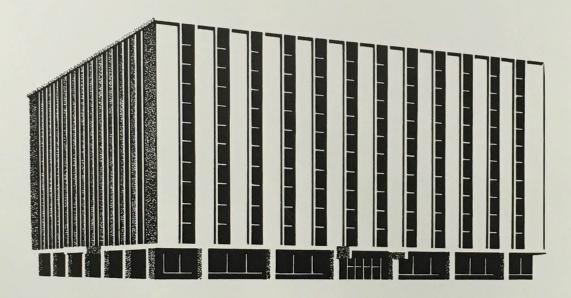
The building will be electrically heated and cooled by a centrifugal dual condensing refrigeration machine and supplemental steam boiler. Koppers duct silencers and acoustical ventilation louvers will

hush the noise generated by this equipment and reduce the overall noise level both inside and outside the building.

Designers were particularly concerned with the air intakes and discharges located near the entrance of the three-story brick and glass structure. To prevent the noise from bothering passers-by, they are installing Koppers Acoustilouvres. The Acoustilouvre not only performs all the functions of an intake louver

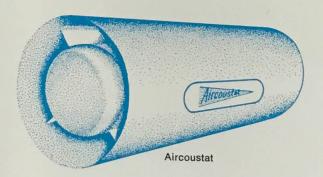
but absorbs fan noise, without interfering with air flow. To reduce fan and duct noise inside, Aircoustats® are being installed in the duct system. Koppers makes a variety of sound conditioning systems and sound traps, plus modular component units for absorbing sound in a wide variety of commercial and industrial enclosures.

Architect: Hoyle, Doran and Berry Boston, Massachusetts









Koppers Company, Inc. Pittsburgh, Pa. 15219

## **KOPPERS**

Architectural and Construction Materials

KOPPERS DESIGN IDEAS



Koppers building products are solutions to problems. Since not all problems fit neatly into categories, neither do all of the products. Here are eight answers in search of a question, especially if it's a question of thermal insulation, park and recreation structures, pavement sealing, light standards, outdoor walkways, boat docks, paddle tennis decking, and wood foundation systems.







How to seal 40 acres of pavement. Someone at Western Electric's Kearney, N. J., plant had the forethought to schedule parking lot repairs for the annual vacation shutdown-when the lot would be empty. Next problem: how to repair and seal

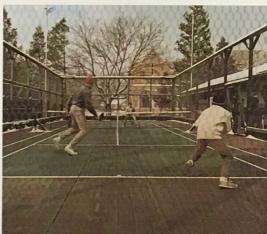
forty acres of pavement in two weeks. A mobile sweeper quickly cleaned the lot with steel gutter brushes; a crew repaired the cracks; and then came the sealant: two coats of Koppers coal tar emulsion pavement sealer. This sealer resists the soften-

ing effects of gasoline and oil, and it stops freeze-thaw damage because it prevents water seepage. The second coat contained silica sand for increased surface traction. In six working days, the entire job was done.

A new day in dock comes in module: float—most of the dock building simpart of the thinkir modular floating of make it possible the costs drastically into business ove units are literally Designs for child-pleasing. Kids playing in the parks of Maryville, Tennessee, not only can swing, slide, and see-saw, they can defend a wild west fort, climb the mast of a pirate ship, or prowl through a jungle maze of wooden poles. They are enjoying a wealth of unusual park and playground structures, all designed in wood to suit the rustic park environment. Both Sandy Springs and Everett Parks in Maryville were designed with Cellon® treated wood from Koppers. The wood is pressure treated with a preservative that resists decay and termite attack, but its surface is left in its natural color, clean and oil-free.

Architect: Oliphant and Kersey, Inc.



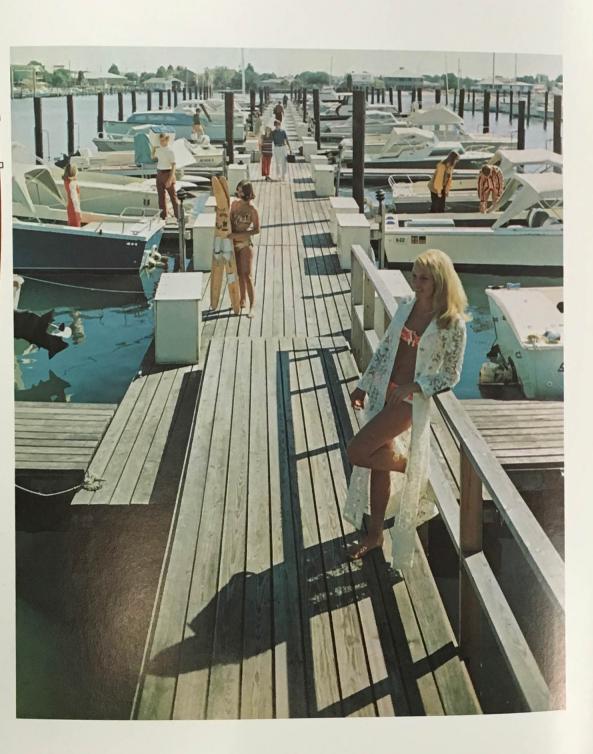


The court case for wood decking. The vast acreage of wood playing surfaces is growing again, this time out of doors. What started the latest surge is the remarkable growth of paddle tennis as a winter sport. Wood makes the best playing surface, and Wolmanized® and Cellon® pressure-treated lumber give decking and structurals permanent protection from rot, decay, and termites. The same courts are good for various other sports, even outdoor dining, dancing, and parties. One manufacturer offers a prefabricated court and suggests that where land is scarce, the structure can be raised a few feet to furnish sheltered parking space underneath.



A new day in docks. When the dock comes in modules—and the modules float—most of the uncertainties about dock building simply vanish. That's part of the thinking behind Koppers modular floating dock systems. They make it possible to reduce labor costs drastically and to put a marina into business overnight. Flotation units are literally unsinkable (pon-

toons are filled with buoyant Dylite® expanded polystyrene) and each is structurally independent. They can be attached, detached, formed or re-formed into any docking pattern. There are 48 different modules, each with stained Cellon® treated decking and handsome laminated sideboards.



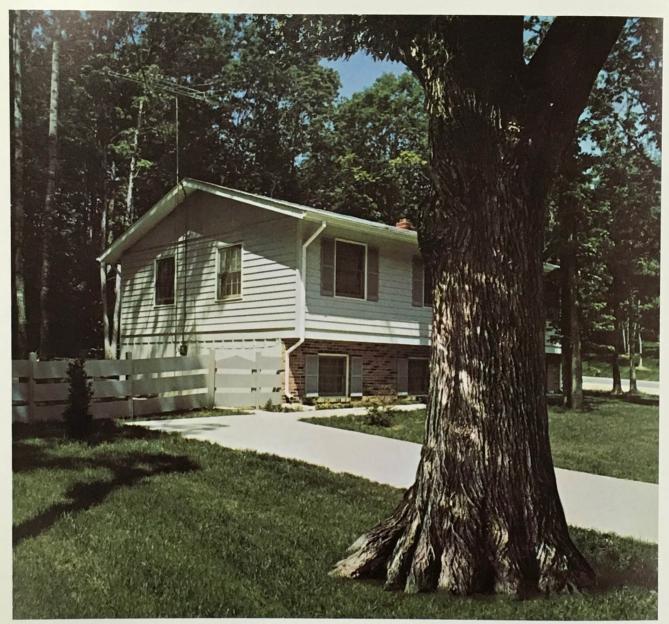
Fire resistant insulation. Refrigerated warehousing can be designed to beat the heat in more ways than one. This 3 million cubic foot cold storage food center has wall, roof, and floor insulation made from a special fire resistant foam plastic: a self-extinguishing grade of Dylite® expanded polystyrene from Sinclair-Koppers Company. Dylite is the same rigid foam used in picnic coolers and hot drink cups. Used in insulation board, it has an extremely low "K" factor and is inert to fungus and bacteria.







The boardwalk, at home. In a parquet pattern writ large, wood makes an interesting outdoor walkway. It weathers well because boards for the walk and its planters are pressure treated by Koppers with Wolman® preservative salts, forced deep into the cell structure to protect against decay and insect attack.



Wood foundations? This house has one. So does the tree. Wood foundation systems promise important savings of time and money in home construction. First, Koppers pressuretreats the wood to give it permanent resistance to decay and termites. It's protected by Wolman® CCA preservatives that will not wash out.

(Wolmanized® lumber has been used for mine timbers and utility poles that are perfectly sound and still protected after decades of use.)

Wolmanized treated footers are placed on a prepared gravel base. Prefabricated foundation wall sections are nailed into place, complete with windows, and the foundation

system is ready in as little as an hour and a half. This method is not only far faster than masonry construction, it can also be installed in any kind of weather. Result: savings on labor, savings on materials, and freedom from costly weather delays.

Wood foundations may work even better for houses than they do for trees.

Koppers Company, Inc. Pittsburgh, Pa. 15219

**KOPPERS** 

Architectural and Construction Materials



Koppers Company, Inc., Pittsburgh, Pa. 15219



## TENNANT COMPANY

P.O. Box 1452 701 N. Lilac Drive, Minneapolis, Minn. 55440

(612) 545-3771 • TLX 290-451

Dear Sir:

This Michigan metal stamping firm fabricates 400,000 lbs. of steel a month -- and floors look new.

They're bright, smooth, oil-free and easy-to-clean -- just as your floors can be -- with the Tennant Floor Maintenance System.

Your floors will stay clean, dustfree and glossy with mechanized clean-up. They remain level -resist grease and oil damage with



Cuts labor costs. Allows fast, easy soilage cleanup. Spillage can't cling to this hard smooth surface.

the right Tennant Concrete Floor Finish -- and they're protected from chemical spillage and wear.

All this with your present maintenance crew, perhaps less.

The "System" starts when a Tennant Floor-Care specialist surveys your plant and recommends your maintenance plan -- based on your square footage, soilage, plant traffic, production schedule, etc.

The recommendation specifies the right floor coating for you, the right sweeper, scrubber or scarifier for your plant. It includes the total price -- and a breakdown so you can budget -- in steps if you wish -- for the particular result you want from the "Maintenance System".

And best of all -- there's no charge for the survey and recommendation.

Some efficient maintenance systems started with the survey, like the ones at Ford, General Electric, RCA, John Deere, Caterpillar, Malone & Hyde and others.

For more facts on the maintenance system for you -- or your free plant survey -- just mail the card.

Cordially,

TENNANT COMPANY

James P. Mannelly Field Sales Manager



Systemized floor care keeps work areas looking like this. 30"-path battery-powered Scrubber (which can switch to sweeping) removes grime from Urethane-coated floor.

### No grime or bumpy floors

# Stamping Plant Looks Like Auto Showroom

Van Wormer Industries, St. Clair Shores, Michigan, stamps 400,000 to 500,000 lbs. of steel per month to supply parts for the auto industry—and their plant looks like an automobile showroom.

Steel salesmen, accustomed to stamping plant operations step into the 90,000 sq. ft. facility and "their eyes pop," says Superintendent Anthony Wise.

#### Had Build-Up Problem

It was not always like this. Unlike the present facility completed this January, floors in the old plant had a build-up problem. Oil, "oil-dry" and dirt packed down under traffic. Deposits were 1/4" thick in some areas.

Using a spud-bar, a man periodically scraped areas where major build-up slowed material handling and created a slip-hazard. Clean-up was slow and tiring. Hand-sweeping didn't help much.

## Tennant Suggests System For Floor Care

A new system for floor care was planned for the new building which not only eliminated former problems, but helped change the working environment in the new structure.

Key to the system is a 2-coat industrial finish (Tennant Urethane) which was applied to concrete floors before moving in. The coating was applied by a contractor who did the job over a weekend.

Then cleanup was mechanized. Machines could keep appearance high and help extend floor finish life by removing grinding dirt and soilage faster than hand methods.

After 5 months (when photos were taken) the only signs of wear to the finish were in the men's room near the washing sink and in a spot or two where heavy steel loads (some banded coils of steel weigh over 20,000 lbs.) scraped off small amounts. These areas can be touched up when desired.

#### **Daily Schedule**

Each morning at 10:30, a man sweeps 50,000 sq. ft. of aisles, and outside loading area and driveway using a 40" path Tennant Sweeper. The job takes 45 minutes.

From 2 to 4 each afternoon, he scrubs aisles free of oil using a 30" path battery-powered Tennant Scrubber. Hand-mopping near machines is also done at this time.

The rest of his day is spent cleaning wash rooms, painting production machines and doing a variety of maintenance tasks.

Since the floor finish keeps oily soilage on top for easy removal—floors stay free of stains and bumpy build-up. Slip-hazard has been greatly reduced.

And "oil-dry," formerly used at the rate of 50 bags (50 lbs. each) each month—is no longer needed. The economic effect on material handling speedup is harder to measure.

The "new look" is especially noticed by auto-officials who tour the plant. Mr. Van Wormer encourages these visits feeling his bright, well-lighted, well maintained plant suggests efficient management and a quality product.

130 131



Ac

hv	State	Zip
ldress		
mpan	y .	
ame	Title	
	○ Epoxy	
	O Urethane	
0	Floor finishes for concrete	
	sweeps 34", scrubs 30" pat	
0	Walk-behind sweeper/scrubbe	r
0	Mid-size sweeper, 40" path.	
0	Large rider sweeper/scrubber sweeps 53", scrubs 50" pat	
	Please send bulletin on	
0	Please send specialist who will plant improving survey.	ll give

2001

## FIRST CLASS

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## TENNANT COMPANY

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Connectorail' System

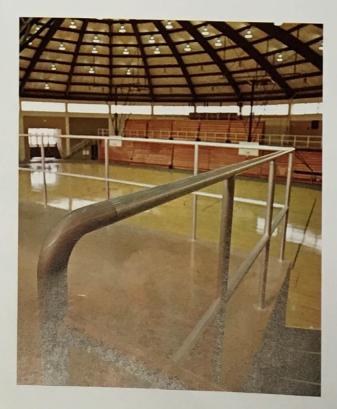
Non-Welded Aluminum & Stainless Steel Pipe Railing System





South Seattle Community College Seattle, Washington Ralph H. Burkhard, Architect Fentron Industries, Fabricator

Charlotte Public High School Charlotte, Michigan Louis C. Kingscott and Assoc., Architects Kehr Iron Works, Inc., Fabricator



Connectorail is an easy to assemble pipe railing system that is fabricated quickly without welding. Components slip together and are joined by concealed mechanical fasteners at intersections and by epoxy structural adhesive at splice joints.

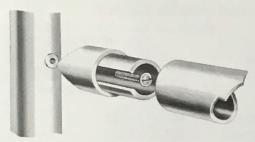
Ready-to-use Connectorail components eliminate the need for welding and grinding. Fabrication requires only cutting to length and drilling for fasteners. The Connectorail system has been designed to assure structural soundness and proper alignment; posts and top rails run in continuous lengths uninterrupted by cross and tee fittings. The system has been engineered and tested to assure structural strength and integrity when properly installed. Components for all common railing conditions are available from stock for immediate shipment.

Previously available in aluminum only, the Connectorail system is now also furnished in Type 304 stainless steel with a No. 4 polished finish. Stainless steel fittings are furnished for 1½" Schedule 5 pipe size ornamental grade tubing (1.900" O.D. x .065" wall). Stainless steel Connectorail can also be fabricated by welding for installations where this type of construction is required. The use of Connectorail fittings eliminates notching and grinding and permits rapid welding with a minimum addition of weld metal.

Connectorail is also provided in 6063 aluminum alloy in either clear anodized or smooth mill finish. Lightweight Schedule 10 pipe size tubing is specially extruded to close dimensional tolerances with a clean, smooth surface finish. All components are carried in stock for 1¼" (1.660" O.D. x .109" wall) and 1½" (1.900" O.D. x .109" wall) pipe sizes.

Properties of sections for Connectorail pipe are listed on page 8. Other detailed information for the structural design of Connectorail handrail installations and guide specifications are available on pages 8 thru 11.

#### **ALUMINUM / STAINLESS**



#### MECHANICAL CONNECTIONS

Non-welded connections eliminate welding discoloration and expensive grinding. Strong structural adhesive, stainless steel machine screws with lock washers, and threaded tubular rivets assure positive connections at joints.



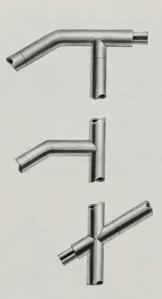
#### CONTINUOUS POSTS AND RAILS

Posts and top rails run in continuous lengths, thus providing a system that is inherently stronger than one with cast tee and cross connections.



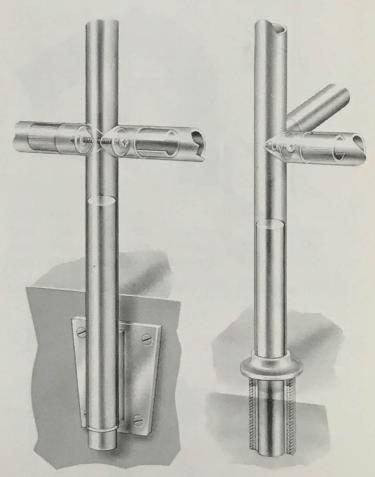
#### ADJUSTABLE BRACKETS

An adjustable bracket may be fitted to the post by means of a simple adapter. The handrail bracket tilts to conform to stair angle. Recommended for ramps or unusual stair angles.



#### **FULL RANGE OF FITTINGS**

A complete selection of fittings is offered by the system. A suitable fitting is available for practically any railing condition.



#### OPTIONS FOR MOUNTING

Connectorail posts may be embedded in floor slab or side mounted on facia or stringer by means of facia flanges. A reinforcing insert can be used at the base of the post for added strength and stiffness.

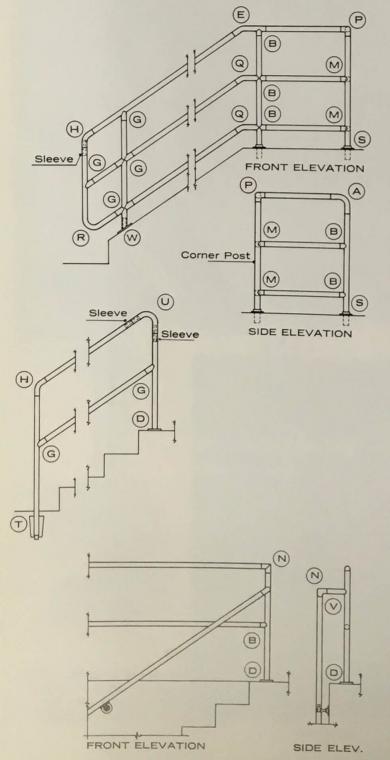
## Connectorail® System



#### ALUMINUM/ STAINLESS

Aluminum Connectorail pipe is extruded with special accuracy and surface quality for close match with Connectorail fittings, but is priced as low as ordinary Schedule 10 light wall pipe. Aluminum fittings and pipe are carried in stock with mill finish and clear anodized finish. When specifying anodized fittings, add the suffix "A" to catalog number listed (e.g. 7140-A).

Stainless steel Connectorail pipe is Type 304 ornamental grade tubing. Pipe and fittings are carried in stock with No. 4 polished finish.



#### Connectorail PIPE 20' Lengths

Aluminum: Alloy 6063-T5 Schedule 10-light wall. Clear anodized or mill

finish.

Stainless: Type 304 Schedule 5-ornamental grade. No. 4 polished

finish fully masked.

		а	b
11/4"	Aluminum	.109"	1.660"
11/2"	Aluminum	.109"	1.900"
11/2"	Stainless	.065"	1.900"

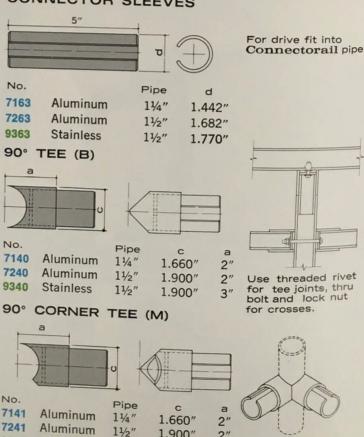
#### HIGH STRENGTH Connectorail POSTS (Aluminum only)

Alloy 6063-T832 Schedule 10-light wall drawn pipe precut to post lengths. Clear anodized or mill finish.

			length	С
7103	11/4"	Aluminum	38"	1.660"
7104	11/4"	Aluminum	50"	1.660"
7203	11/2"	Aluminum	38"	1.900"
7204	11/2"	Aluminum	50"	1.900"

Also available in 20' lengths in mill finish only.

#### CONNECTOR SLEEVES

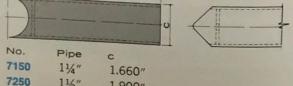


1.900"

1.900"

2"

3"



11/2"

11/2"

90° 6" TEE (V) (Aluminum only)

1.900"

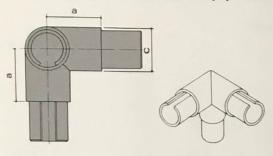
Stainless

11/2"

9341

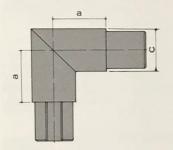
#### **ALUMINUM / STAINLESS**

#### 90° THREE WAY ELBOW (P)



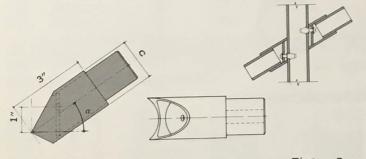
No.		Pipe	С	а
7130	Aluminum	11/4"	1.660"	2"
7230	Aluminum	1½"	1.900"	2"
9330	Stainless	11/2"	1.900"	111/16"

#### 90° MITER ELBOW (N)



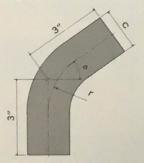
No.		Pipe	С	а
7111	Aluminum	11/4"	1.660"	2"
7211	Aluminum	1½"	1.900"	2"
9311	Stainless	1½"	1.900"	111/16"

#### ANGLE TEE (G)



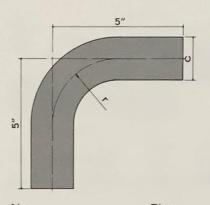
29°a	32°α	35°α	38°α		Pipe	С
7139	7142	7145	7148	Aluminum	11/4"	1.660"
7239	7242	7245	7248	Aluminum	11/2"	1.900"
1239	1242			Stainless	11/2"	1.900"
9339	9342	9345	9348	Stainless	172	1.500

### POST ELBOW (H)



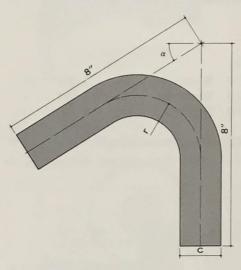
200	200.	35°α	38°α		Pipe	c	r	
29-4	32.0	35 0	30 a			1 0001	21/2"	
7119	7122	7125	7128	Aluminum	11/4"	1.660"	242	
				Aluminum	11/5"	1 900"	3"	
7219	7222	7225	7228	Aluminum	172	1.500	-	
9319	9322	9325	9328	Stainless	11/2"	1.900"	3"	

#### 90° RADIUS ELBOW (A)



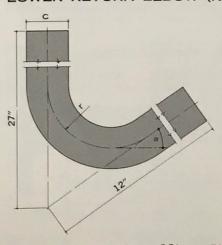
	Pipe	С	r
Aluminum	11/4"	1.660"	21/2"
Aluminum	11/2"	1.900"	3"
Stainless	11/2"	1.900"	3"
	Aluminum	Aluminum 1½" Aluminum 1½"	Aluminum 1½" 1.660" Aluminum 1½" 1.900"

#### UPPER RETURN ELBOW (U)



29°α	32°α	35°α	38°a		Pipe	С	r
7179	7182	7185	7188	Aluminum	11/4"	1.660"	21/2"
7279	7282	7285	7288	Aluminum	11/2"	1.900"	3"
9379	9382	9385	9388	Stainless	11/2"	1.900"	3"

#### LOWER RETURN ELBOW (R) (Aluminum only)



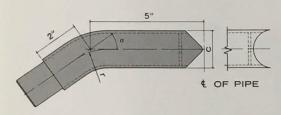
29°α	32°a	35°a	38°a	Pipe	C	r
7129	7132	7135	7138	11/4"	1.660"	21/2"
7229	7232	7235	7238	1½"	1,900"	3"



### Connectorail® System

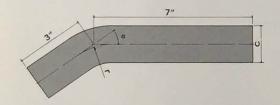
ALUMINUM / STAINLESS

#### RAIL ELBOW TEE (Q) (Aluminum only)



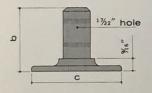
29°α	32°α	35°α	38°a	Pipe	С	r
7149	7152	7155	7158	11/4"	1.660"	21/2"
7249	7252	7255	7258	11/2"	1.900"	3"

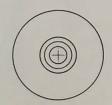
#### RAIL ELBOW (E)



29°α	32°α	35°α	38°α		Pipe	С	r
7109	7112	7115	7118	Aluminum	11/4"	1.660"	21/2"
7209	7212	7215	7218	Aluminum	11/2"	1.900"	3"
9309	9312	9315	9318	Stainless	11/2"	1.900"	3"

#### FLOOR FLANGE (D) (Aluminum only)

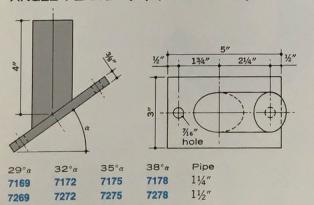




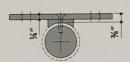
No.	Pipe	С	b
7170	11/4"	4"	23/8"
7270	1½"	4 1/2"	2 5/8"

When using floor flanges or angle flanges for surface mounting of posts, care must be taken to provide adequate lateral bracing. The use of floor flanges or angle flanges as the only means of railing support is not recommended.

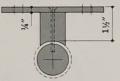
#### ANGLE FLANGE (W) (Aluminum only)



#### FACIA FLANGE (T)



No.		Pipe	а	
7190	Aluminum	11/4"	15"	
7290	Aluminum	1½"	15"	
7293	Aluminum	1½"	24"	
9390	Stainless	1½"	26"	

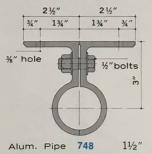


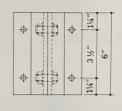
No.		Pipe	а
7191	Aluminum	11/4"	15"
7291	Aluminum	1½"	15"
7294	Aluminum	11/2"	24"
9391	Stainless	11/5"	26"

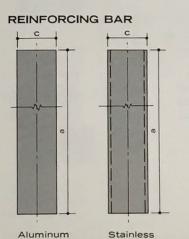
Facia Flanges are supplied complete with two %6" stainless steel bolts for assembly to pipe post.

(Aluminum only)

#### ROOF RAILING FLANGE 6063-T6 Unpolished





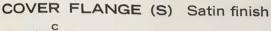


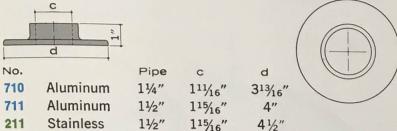
1	_ <	5
varies		
6"	-	1

No.		Pipe	c	а
7192	Aluminum	11/4"	1.427" (6063-T6)	15"
7292	Aluminum	1½"	1.667" (6063-T6)	15"
7295	Aluminum	11/2"	1.667" (6063-T6)	24"
9392	Stainless	1½"	1.750" x .083" wall	26"

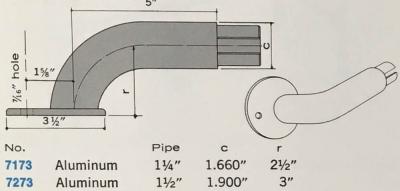
Floor mounting is best accomplished by mounting in concrete. Reinforcing bars are recommended for floor mounted posts.

#### ALUMINUM / STAINLESS





#### WALL RETURN



1.900"

3"

Stainless

Stainless

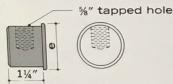
1/2" tapped hole

end cap

11/2"

FND	CAP

9373



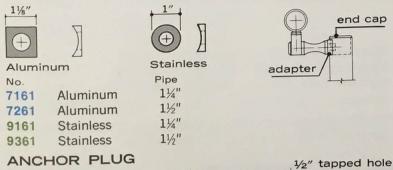
**Stainless** 

#### Aluminum

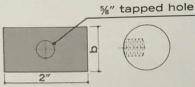
No.		Pipe	е
7180	Aluminum	11/4"	1.660"
7280	Aluminum	11/2"	1.900"
9380	Stainless	11/2"	1.900"

Aluminum End Cap is machined from solid stock to provide secure mounting for handrail brackets. Stainless steel End Cap is fabricated from heavy gauge metal.

#### BRACKET POST ADAPTER



#### ANCHOR PLUG

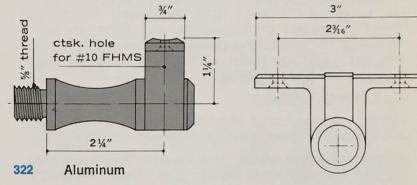




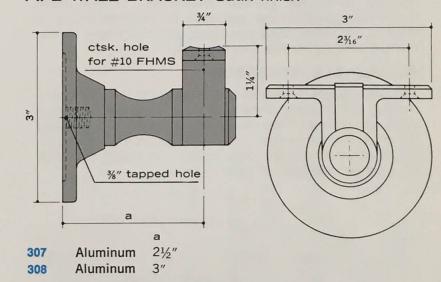
	100 marie 100		
No.		Pipe	b
7162	Aluminum	11/4"	1.427"
7262	Aluminum	11/2"	1.667"
0362	Stainless	11/5"	1.750"

Anchor Plug provides secure mounting for brackets supporting second or third rail. Aluminum Anchor Plug is machined from solid stock; stainless steel Anchor Plug is fabricated from heavy metal.

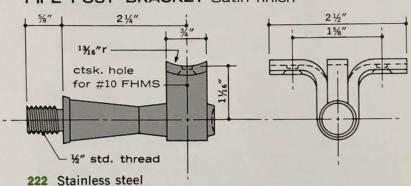
#### PIPE POST BRACKET Satin finish



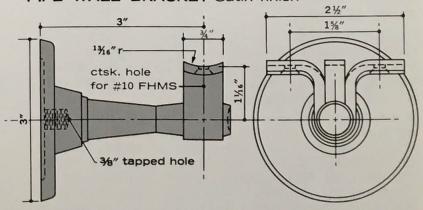
#### PIPE WALL BRACKET Satin finish



#### PIPE POST BRACKET Satin finish



#### PIPE WALL BRACKET Satin finish



223 Stainless steel

#### **BRACKET EXTENSIONS**

Post and wall bracket extensions are available for the brackets above. Extensions increase the bracket offset by  $1^{\prime\prime}$  3". See our Catalog 11 for details.

#### INTRODUCTION

To assist architects and designers to select Connectorail components, we have included methods for structural design in this section. This methodology has been verified by tests of components and assemblies.

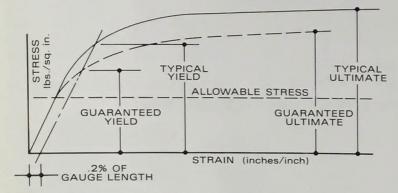
#### **BUILDING CODES**

Many building codes specify location, dimensional and structural strength requirements for handrails.

Regulations issued by the Department of Labor for the Occupational Safety and Health Administration provide dimensional and structural strength requirements for certain buildings. These state that railings shall be capable of withstanding a load of "at least 200 pounds applied in any direction at any point on the top rail."

#### ALLOWABLE STRESSES

The allowable handrail load is obtained by comparing the stress obtained at the design loading with the guaranteed minimum yield stress divided by a factor of safety of 1.65 (Guaranteed minimum strength is the test value exceeded by 99% of a large number of specimens).



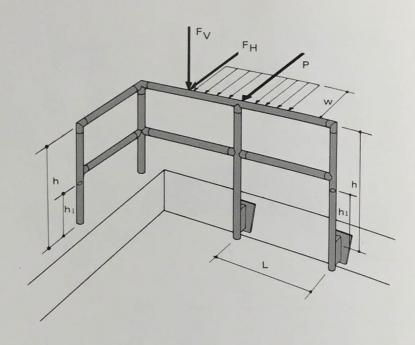
The material stress-strain curve for aluminum, bronze and stainless steel has no definite yield point (see graph). It is customarily defined by a line drawn parallel to the initial slope of the stress strain curve and offset by a strain of .2% of gauge length (percentages varying from .1% to .5% are used by some data sources). A much larger strain occurs before failure.

#### TEST DATA

In a typical test of a railing designed by use of the methodology used herein, initial permanent yielding will occur at approximately twice the design load, and failure will usually occur at approximately 2½ times the design load.

If structural design is based upon permanent set measured in structural tests rather than upon minimum yield strength, the factor of safety should be increased to allow for the normal variation in the material. Most codes specify that if tests of completed structures are required, they should be loaded to twice design load without exceeding a specified (small amount) of permanent set. Therefore, if allowable strength is based directly upon test results, the factor of safety should be increased from 1.65 to 2.0.

#### LOADING DIAGRAM



#### **EXPLANATION OF SYMBOLS**

w = Uniform horizontal loading, lbs/ft (perpendicular to the rail).

L = Span between centerlines of posts, or brackets (inches).

P = Horizontal force, perpendicular to rail applied at top of post (lbs).

F<sub>H</sub> = Horizontal force, perpendicular to rail at any point along the railing (lbs).

 $F_V = Vertical$  force, perpendicular to rail at any point between posts (lbs).

h = Height of post. Distance from point of load application above top of attachment (in).

h<sub>1</sub> = Distance from top of post attachment to top of insert (in).

t = Wall thickness (in).

fs = Allowable stress for design (psi)

f = Unit stress (psi).

S = Section modulus (in<sup>3</sup>).

S<sub>1</sub> = Combined section modulus of post with reinforcing insert.

I = Moment of inertia (in<sup>4</sup>).

#### MECHANICAL PROPERTIES OF MATERIALS

Material	Allowable Stress (psi)	Minimum Yield (psi)	Modulus of Elasticity (psi x 10 <sup>6</sup> )	
Aluminum 6063-T5	11,000*	16,000	10.0	
Aluminum 6063-T832	21,000	35,000	10.0	
Stainless Type 304	30,000	50,000***	28.0	

\*Allowable = 16,000 x 1.17 ÷ 1.65 Ref. ASCE paper 3342.

### SECTION PROPERTIES FOR Connectorail PIPE

	Nominal Size	Outside Diameter	Area	- 1	S	t	
Sched 10 Aluminum	1¼" 1½"	1.660 1.900	.531 .614	.161 .247	.193 .260	.109	
Sched 5 Stainless	1½"	1.900	.375	.158	.166	.065	
Stainless Insert		1.750	.435	.151	.173	.083	
Stainless Tubing Post combined with insert (S <sub>1</sub> )	1½"	1.900	.810	.309	.325	.148	

<sup>\*\*50,000</sup> psi. minimum yield guaranteed by producing manufacturer of Connectorail stainless tubing.

### Connectorail ENGINEERING DATA POSTS: ALLOWABLE SPACING

The allowable spacing for aluminum posts is given by:

$$L = \frac{12f_S \times S}{w (h-h_1)}$$

The critical height of the post for bending is measured from the top of the solid reinforcing insert (h-h<sub>1</sub>). h<sub>1</sub> is either 9" or 18", measured from point of attachment.

The allowable spacing for stainless steel posts is given by L<sub>1</sub> or L<sub>2</sub>, whichever is smaller.

$$L_1 = \frac{12 \, f_8 \, x \, S_1}{w \, x \, h} \qquad S_1 = .325 \, inches^3$$
 or by 
$$L_2 = \frac{12 \, f_8 \, x \, S}{w \, (h - h_1)} \qquad S_1 = .166 \, inches^3$$
 
$$h_1 = 20 \, inches$$

### POSTS: ALLOWABLE LOAD

The allowable horizontal load at the top of the post is:

Aluminum system 
$$P = \frac{f_S \times S}{h-h_1}$$

Stainless Steel system

the smaller of 
$$P_1 = \frac{f_S \times S}{h-h_1}$$
 or  $P_2 = \frac{f_S \times S_1}{h}$ 

### RAILING: ALLOWABLE SPAN\*

For concentrated loads applied to the railing, the allowable span is:

$$L = \frac{4 f_S \times S}{F_V}$$
 or  $L = \frac{4 f_S \times S}{F_H}$ 

For distributed loads the allowable span is:

$$L = \sqrt{\frac{8 \times 12 \times f_8 \times S}{W}}$$

\*In most cases the allowable span between posts will be governed by allowable post loading rather than rail loading.

## RAILING: ALLOWABLE LOADS\*

For concentrated loads applied to the rail, the allowable loading is:

$$F_H = F_V = \frac{4 f_S \times S}{L}$$

For uniform loadings applied to the rail, the allowable loading is:

$$w = \frac{12x8 f_S x S}{L^2}$$

For a continuous top rail, neither FH nor w x L can exceed P, the allowable post load.

\*These expressions assume pin joints at the posts. Somewhat higher values of F<sub>V</sub> and w<sub>V</sub> can be obtained by increasing the values of 4 and 8 used above when the railing is continuous.

## Connectorail LOADING TABLES

The values tabulated apply to installations fabricated and erected in accordance with the Connectorail specifications. Chart values have been determined by assuming that reinforcing bars have been used with floor mounted handrails.

In the tables, the maximum railing span has been limited arbitrarily to 72" for aluminum and to 96" for stainless steel, because deflection would be excessive for longer spans. All rails for the aluminum system are 6063-T5.

Connectorail	LOADING	<b>TABLES</b>	(cont'd)

onnectorail	LOADI	NG	TABL	ES (co	nt'd)
1½" pipe 6063-T5 20 lbs/ft	<ul><li>32"</li><li>34</li><li>36</li><li>38</li></ul>	h <sub>1</sub> 9" 9 9	55" 55 47 44	92 lbs. 85 79 73	F <sub>v</sub> 153 lbs. 167 180 198
1½" pipe 6063-T5 20 lbs/ft	<ul><li>32"</li><li>34</li><li>36</li><li>38</li><li>40</li><li>42</li><li>44</li><li>46</li><li>48</li></ul>	9999999	72" 69 64 59 55 52 49 46 44	124 lbs. 114 106 99 92 87 82 77 73	159 lbs. 167 180 193 207 220 233 247 260
1¼" pipe 6063-T832 20 lbs/ft	<ul><li>32"</li><li>34</li><li>36</li><li>38</li><li>40</li><li>42</li><li>44</li><li>46</li><li>48</li></ul>	99999999	72" 72 72 72 72 72 72 69 66 62	175 lbs. 162 150 140 131 123 116 109 104	118 lbs. 118 118 118 118 118 122 129 136
1½" pipe 6063-T832 50 lbs/ft	<ul><li>32"</li><li>34</li><li>36</li><li>38</li><li>40</li><li>42</li></ul>	9" 9 9 9 9	57" 52 49 45 42 40	237 lbs. 218 202 188 176 165	201 lbs. 218 236 253 271 288
1½" pipe 6063-T832 50 lbs/ft	<ul><li>38"</li><li>40</li><li>42</li><li>44</li><li>46</li><li>48</li></ul>	18" 18 18 18 18 18	57" 57 55 50 47 44	273 lbs. 248 227 210 195 182	201 lbs. 201 210 227 244 262
1½" pipe Type 304 20 lbs/ft	<ul> <li>32"</li> <li>34</li> <li>36</li> <li>38</li> <li>40</li> <li>42</li> <li>44</li> <li>46</li> <li>48</li> </ul>	20" 20 20 20 20 20 20 20 20 20	96" 96 96 96 96 96 96 96	305 lbs. 287 271 256 244 226 207 191 178	208 lbs. 208 208 208 208 208 208 208 208 208
1½" pipe Type 304 50 lbs/ft	<ul><li>32"</li><li>34</li><li>36</li><li>38</li><li>40</li></ul>	20" 20 20 20 20 20	73" 69 65 62 58	305 lbs. 287 271 256 244	270 lbs. 290 307 324 341

• 42

• 44

• 46

• 48

20

20

50

226

207

191

178

367

400

434

467

### GUIDE SPECIFICATION for Connectorail®

The following specifications, which are illustrative only, are designed to assist the specification writer. In order to secure more accurate bids, a higher class of workmanship, and the establishment of direct responsibility, it is recommended that all Connectorail work be specified as a special section of the miscellaneous metalwork specification.

#### 1. GENERAL CONDITIONS:

The General Conditions of the Contract for the Construction of Buildings, Standard Form of American Institute of Architects, latest edition, and the Supplementary General Conditions are hereby made a part of these specifications to the same extent as if bound herein.

#### 2. SPECIAL CONDITIONS:

- (a) Approved fabricators for this work are as follows: (list approved companies).
- (b) Other fabricators will be considered, provided that written approval for submission of bids is granted by the Architect.
- (c) This fabricator shall examine the contract drawings and these specifications to ensure that the work is complete. Should errors, omissions or inconsistencies be found, he shall notify the Architect and General Contractor in writing and shall list any qualification affecting his bid.
- (d) This fabricator shall coordinate his work with that of other trades, and shall promptly furnish all items to be installed by others when so requested.
- (e) To ensure that he may effect a first-class installation of his work, this fabricator shall examine all prior work by others affecting the work hereunder. Any defect or omissions so found shall be reported in writing to the Architect and General Contractor before any work hereunder is started.
- (f) This fabricator shall make allowance for normal construction tolerances and provide those accessories and fabrication variations required to compensate for the above.

#### 3. SCOPE OF THE WORK:

- (a) This fabricator shall furnish all labor, materials, equipment and services required to complete the railings and related work indicated on the drawings or specified herein.
- (b) This fabricator shall submit (number) copies of completely detailed shop drawings to the Architect for approval. Drawings shall show clearly all materials, finishes, connecting and joining methods, and the relationship to

adjoining work by others. No fabrication work shall be started until shop drawings have been approved.

#### 4. WORK NOT INCLUDED:

 (a) (List here those items and services to be provided under other divisions of the specifications.)

#### 5. MATERIALS:

- (a) All Connectorail components shall be the products of Julius Blum and Company, Inc., Carlstadt, New Jersey. Components shall be manufactured of 6063 Aluminum alloy or Type 304 Stainless Steel as specified below:
  - i. Connectorail pipe for aluminum posts and rails shall be schedule 10 lightwall pipe of aluminum alloy 6063.75, extruded with special accuracy and surface quality for close match with Connectorail fittings. Wall thickness shall be 0.109". Outside diameter for nominal 1¼" pipe shall be 1.660". Outside diameter for nominal 1½" pipe shall be 1.900".
  - ii. High Strength Connectorail aluminum posts, when so specified, shall be fabricated from schedule 10 light wall drawn pipe of aluminum alloy 6063-T832.
  - iii. Stainless Steel posts and rails shall be fabricated from welded (unannealed) Type 304 tubing with 50,000 psi minimum yield strength guaranteed. Elbows may be fabricated from welded Type 304 tubing, annealed after welding. Wall thickness shall be .065". Outside diameter shall be 1.900".
  - iv. Connectorail Fittings shall be manufactured of wrought material of the same composition as the posts and rails. Tee-fittings and elbows which are fabricated from more than one piece shall be of welded construction with no weld marks visible when the fitting is installed. All surfaces which mate with Connectorail Pipe or tubing shall be precisely machined and free from burrs.
- (b) All mechanical fasteners used in the assembly of Connectorail shall be of aluminum or stainless steel. Fasteners or fastening devices substituted for those listed below shall not be considered satisfactory.

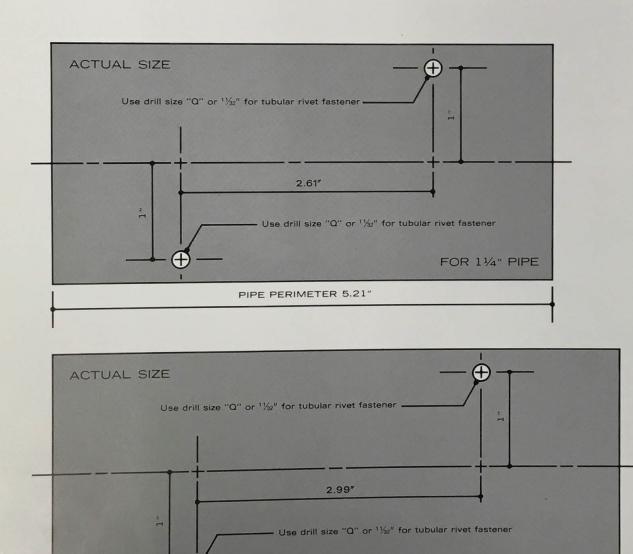
NOTE: Connectorail engineering properties as published by Julius Blum and Company, Inc., are not valid if substitute fasteners are employed.

i. Internally threaded tubular rivets shall be used for tee connections into Connectorail pipe or tubing. They

## Connectorail® System

#### ANGLE TEE TEMPLATE

Suggested templates for use in locating holes for Connectorail Angle Tees: Holes are located 1" above and below intersection of center lines of pipe, regardless of stair angle.



PIPE PERIMETER 5.97"

FOR 11/2" PIPE

## Connectorail® System



shall be of the same metal as the posts, and shall accept a  $\frac{1}{4}$ " x 20 machine screw.

- ii. SEMS Screws or stainless steel round head (Phillips) machine screws with lock washers, size ¼" x 20, shall be used with internally threaded tubular rivets to attach tee-fittings to pipe.
- iii. When 90° tee-fittings are mounted opposite each other on the same axis, a single ½" x 20 stainless steel machine screw and lock nut may be used instead of rivets if desired. (1½" pipe requires a 2½" screw; 1½" pipe requires a 3" screw.)
- iv. 3-M Scotch-Weld Adhesive, EC-2216 B/A, a two-part epoxy compound, shall be used for permanent splice connections.
- v. Machine screws used to mount Connectorail Facia Flanges to stringers shall be of stainless steel, galvanized steel, or cadmium plated steel, and be \%6" in diameter.

#### 6. DISSIMILAR MATERIALS:

- (a) When Connectorail components come in contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with proper primer or paint.
- (b) When Connectorail components come in contact with concrete or lime mortar, exposed aluminum surfaces shall be painted with alkaline-resistant coatings such as heavy bodied bituminous paint or water-white methacrylate lacquer.
- (c) Where aluminum parts are placed in contact with wood or other absorbtive materials which may become repeatedly wet, the aluminum parts shall be painted with two coats of aluminum metal-and-masonry paint or coated with heavy bodied bituminous paint.

#### 7. FINISHES:

- (a) When specified, mechanical finishing shall be done in accordance with proper shop practice
- (b) When stock components with 204 R1 anodized finish are specified, no further finishing is required.
- (c) Other electrochemical finishing shall be specified in accordance with industry standards to meet installation exposure or appearance requirements.

## 8. FABRICATION, WORKMANSHIP AND ERECTION:

(a) All work executed under this section shall

be performed in a shop thoroughly experienced in this type of work in accordance with the best modern practice, and of recognized quality acceptable to the architect.

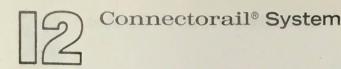
- (b) Assembly of Connectorail components shall be performed in strict accordance with manufacturer's recommendation for assembly.
  - i. Internally threaded tubular rivets shall be installed in Connectorail Pipe wall at all locations where Tee-fittings are to be attached. Care shall be taken to see that rivets are properly headed without stripping threads.
  - ii. Care should be taken to see that machine screws are completely tightened when Tee-fittings are mounted on Connectorail pipe. Flex-Loc nuts, lock washers or a mastic compound manufactured for the purpose shall be used to prevent machine screws from loosening under repeated loading.
  - iii. All sleeve joints and splices for other than temporary installations shall be bonded 2½" into the pipe with 3-M Scotch-Weld epoxy adhesive, EC-2216 B/A. Epoxy shall be mixed and applied strictly in accordance with the manufacturer's instructions, and the one-hour pot life of the mix shall be strictly observed. Prior to the application of adhesive all surfaces to be bonded shall be thoroughly cleaned with an Oakite solution, rinsed and dried. Care shall be taken to see that railings are not disturbed during the required curing period so that epoxy bonds may develop full strength.
- (c) All work shall be free from blemishes or defects of any type which can affect durability, strength or appearance.
- (d) All work shall be complete in every detail. Finished work shall be approved by the Architect before the job will be accepted.
- (e) Erection of Connectorail shall be performed by the fabricator or shall be supervised by his qualified representative.

#### 9. FINAL CLEANING:

(a) Upon completion of the railing installation this fabricator shall clean all work to make it acceptable at the time of final inspection.

#### 10. GUARANTEE:

This fabricator shall furnish to the Architect a written guarantee against any and all defects in workmanship, materials and finish which may appear within a period of one year following acceptance of the work by the Architect.



#### FASTENER Aluminum



Catalog No. A25-140 Aluminum Catalog No. SS25-140 Stainless

The internally threaded tubular aluminum rivet is easily set in Connectorail pipe wall. The rivet provides high strength ½"-20 threads for blind attachment of Connectorail tee fittings.

#### INSTALLATION

Drill pipe with drill size Q or 11/32" hole. Thread rivets on stud of header tool and insert in hole. Apply  $\frac{3}{4}$ " box end or open end wrench to header hex nut and insert hex key in socket. Hold hex key stationary and turn wrench in counterclockwise direction to pull up stud and upset rivet walls. Approximately  $1\frac{1}{2}$  to 2 turns are required to produce complete upset. A box end rachet wrench makes this operation very quick and easy.

#### WRENCH TYPE HEADER



Catalog No. C-845-2520

The wrench type header is a low cost hand tool for setting the internally threaded tubular rivets. The rivet is threaded onto header tool stud and inserted in drilled hole. Jack screw mechanism provides pull-up force to upset the rivet. Pneumatically powered header tools are available for large volume applications.

#### SEMS SCREW and THROUGH BOLTS





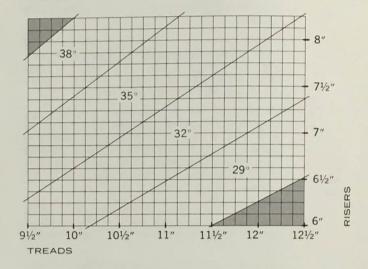




SEMS Screw RHMS¼" x 20 x 1" with lock washer RHMS  $\frac{1}{4}$ " x 20 x 2 $\frac{1}{2}$ " or 3" with lock nut

SEMS SCREWS prevent accidental omission of lock washers and subsequent loosening of joints. The combination of ½" x 20 x 1" stainless steel RHMS with lockwashers and internally threaded tubular rivet fasteners provides connections of ample strength to develop the full loading capacity of Connectorail pipe. Where two 90° tees are mounted opposite each other to form a cross assembly, a stainless steel through bolt with lock nut may be used. For 1½" pipe, use ½" x 20 x 2½" RHMS with lock nut. For 1½" pipe, use ½" x 20 x 3" RHMS with lock nut.

#### ANGLE FITTING SELECTOR CHART



Angle fittings are carried in stock for  $29^{\circ}$ ,  $32^{\circ}$ ,  $35^{\circ}$ , and  $38^{\circ}$  angles of inclination. To select the correct angle fitting for a stairway, plot the intersection of riser and tread dimensions on the chart above. The zone into which the intersection falls will indicate the correct angle value for fittings.

Example: A 7" riser and 10" tread require  $35^{\circ}$  angle fittings.

#### SCOTCH-WELD EPOXY ADHESIVE







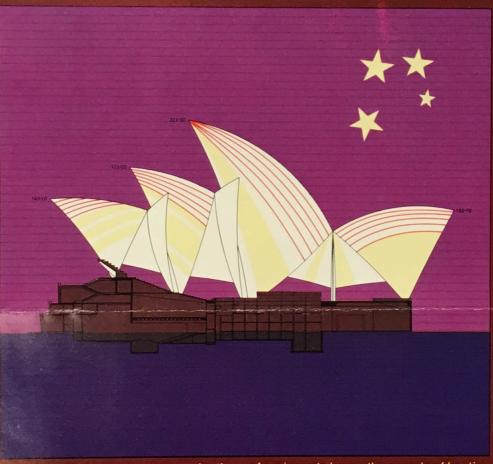
Tubes - 4 oz. (total)

Cans - 1 qt. (total)

#### Catalog No. 3M EC-2216 B/A Clear Amber

SCOTCH-WELD epoxy adhesive is used to make permanent splice connections between Connectorail components. Since structural integrity of Connectorail installations depends on sound splice joints, manufacturer's instructions for application must be followed explicitly:

- Surfaces must be clean and free from grease. Parts should be cleaned with an Oakite solution, rinsed and dried.
- The epoxy adhesive must be properly mixed and the one-hour pot life of the mixture must be observed.
- Apply adhesive generously to both surfaces to be bonded, fit together, and wipe off excess adhesive immediately.
- Allow installation to remain undisturbed for eight hours to allow bond to develop maximum strength. Allow additional curing time in cold weather.



Everything is shipshape. A center for the performing arts keeps the sounds of heating and cooling from mixing with the sounds of music. Fountains and lagoons surround an office building while basement levels beneath the water remain dry. Pressure treatment preserves the wood in a house whose design preserves the woods around it. A place for everything, and well placed building products help to keep everything in its place.

On the following pages, you'll see specific examples of how Koppers products have helped architects and engineers control the effects of environment and obtain greater latitude of design, saving money for clients. Koppers building products are either permanent in themselves or give permanence to other materials.

#### Sorting out sounds in the opera house

It's as if the ghost frigate from Wagner's opera, *The Flying Dutchman*, had sailed into the harbor at Sydney, Australia, about to drop anchor.

Nor is it a coincidence that the new Sydney Opera House strikes a profile suggestive of sailing ships: that is the image to which Danish Architect Jorn Utzon originally attributed



the idea of his curving, winglike roof sections that seem to billow like sails on the horizon.

Geometry of the precast concrete roof is that of sections of spheres with the largest shell rising 220 feet.

Beneath this multiple canopy will be a complete center for the performing arts, including a large concert hall, an opera theatre, drama theatre, exhibition hall, and separate halls for chamber music and cinema, rehearsals, recording, dressing rooms, and restaurants.

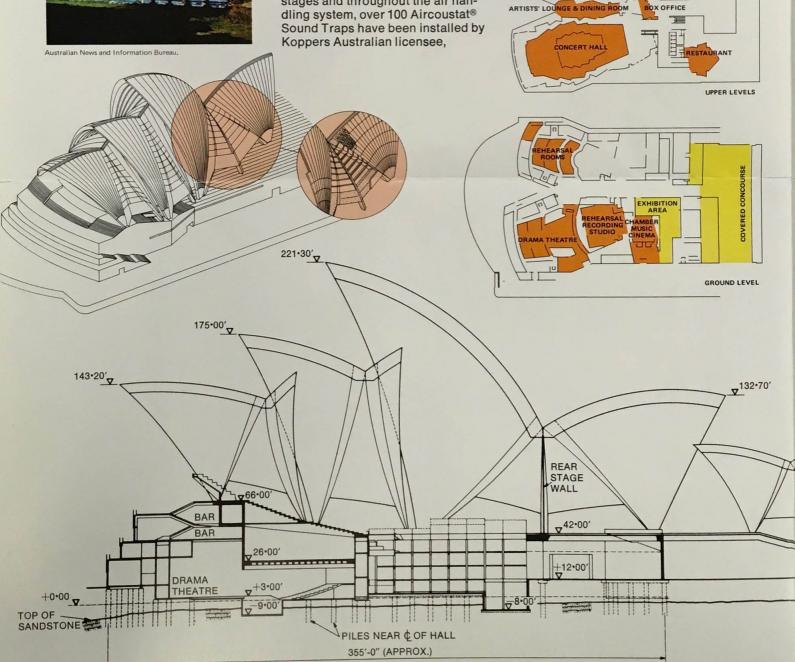
For a structure that might simultaneously host a symphony concert, an opera, a play, and a trade show, effective sound suppression systems were an essential part of the plan. Around and above concert halls and stages and throughout the air handling system, over 100 Aircoustat® Sound Traps have been installed by Koppers Australian licensee

Australian Gypsum Ltd. These sound traps plus another 100 which will be installed before the structure is completed will silence the incoming noise.

These duct silencers use a combination of streamline corrugated baffles and perforations to attenuate noise with minimum effect on air pressure and flow.

Koppers makes a full complement of sound conditioning materials and acoustical devices small enough to fit in the ductwork or large enough to silence a turbine generator. Check the coupon for details.

RECITAL RECEPTION ROOM



## Under the water, everything is dry

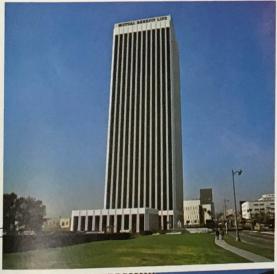
At the base of its soaring white precast columns, the new Mutual Benefit Life Plaza Building in Los Angeles is an island surrounded by freeform lagoons and fountains, Lilies of the Nile, jacaranda, and Canary Island pine.

The structure and its plaza earned a special award from Los Angeles Beautiful, a civic improvement association spearheaded by community leaders.

For architects William L. Pereira Associates, the unusual setting was both a triumph and a problem. Beneath the fountains and lagoons, three levels of parking facilities had to be kept dry.

They specified Koppers coal tar pitch waterproofing systems both for the lagoons and for the building proper. Four plies of tarred membrane alternated with five moppings of Type B pitch form a watertight barrier between basement slabs, at exterior walls below grade, and at planters. For the plaza level, waterproofing includes five plies of tarred felt and five moppings of Type A pitch, with fabric reinforcing at angles. For information on Koppers built-up roofing and waterproofing systems, check the coupon.

Architects: William L. Pereira Associates







## Architectural and Construction Materials

Problems	Low-cost Koppers solutions
Built-up roofing	Reinforcement fabrics, coal tar roofing pitch
Waterproofing	Reinforcement fabrics, coal tar pitch, coal tar waterproofing pitch, cold applied applications
Dampproofing	Same as waterproofing, plus Durethene® polyethylene film
Corrosion protection for steel	Bituminous coatings, synthetic resin coatings
Corrosion protection— concrete & masonry	Bituminous coatings, synthetic resin coatings, coal tar waterproofing pitch
Protection of asphalt pavement	Pavement sealers
Insulation	Dylite® foam plastic board
Low-cost piling, poles and structures	Pressure-creosoted wood
Fire protection for wood	Non-Com® wood, Class "B" & "C" Cedar shakes & shingles, Exterior Non-Com
Termite, rot and decay protection	Pressure-creosoted wood, Cellon® pressure-treated wood, Wolmanized® lumber
Sound control	Aircoustat® sound traps, Acoustilouvres® Soundmetal® panels
Adhesive for wood	Penacolite® adhesives
Structural systems	Laminated arches, beams, decking; reinforced plastic structurals
Environmental control	Aircoustat sound traps, Acoustilouvres, Soundmetal panels, electrostatic precipitators, water and waste treatment equipment

For more information, clip and mail coupon.

Robert M. Winters, Mgr., Architect Koppers Company, Inc. Room 1328, Koppers Bldg., Pittsbi		X-1
Please send me additional informal have checked:	tion about the products	
☐ Aircoustat® silencers ☐ Laminated beams and decking ☐ Wolmanized® lumber and piling ☐ Protective coatings		
Other (Please specify)		
Name		
Title		
Address		
Company		
CitySta	iteZip	

### Under the water, everything is dry

At the base of its soaring white precast columns, the new Mutual Benefit Life Plaza Building in Los Angeles is an island surrounded by freeform lagoons and fountains, Lilies of the Nile, jacaranda, and Canary Island pine.

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Architects: William L. Pereira Associates





#### A house rich in natural wood

It stands on treated wood pilings, exposed inside the house and out. Laminated exposed beams and laminated decking are Southern Pine, as are door frames and the laminated edge-grain ceilings and floors. Siding is rough sawn cedar plywood, applied like clapboard. Paneling, interior doors, and cabinetry are luan mahogany.

Client-contractor Dr. Robert G. Stanley, a forestry professor, and Mrs. Stanley decided to make full use of natural wood in building their house on a sloping lakeside site near Gainesville.

Architect William Morgan, AIA, designed the house in a sequence of platforms, spiraling upward in the form of pinwheels supported on nine wood piles. Pressure-treated by Koppers with Wolman® preservative salts, these piles are bolted to laminated wood



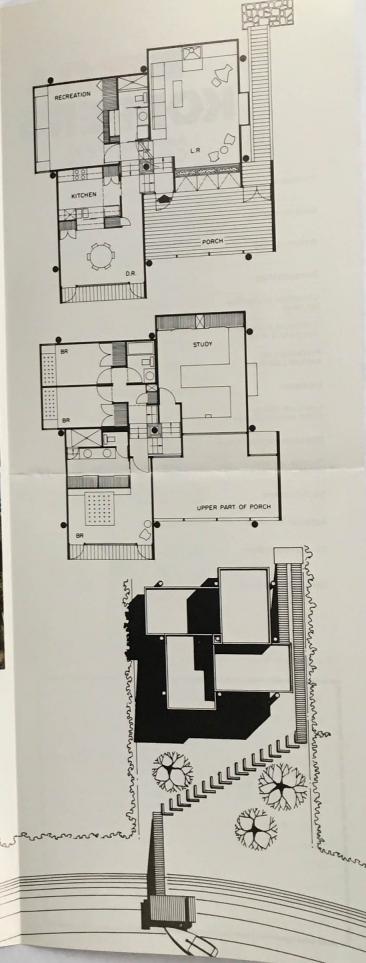


beams supporting exposed floor and ceiling joists. Beams and decking are Koppers laminated wood. The house looks to the lake, open on that side and closed to the other three. Visitors enter by a ramp to the two story porch, then continue up to the living room, bedrooms, and studio, or down to the kitchen, guest suite, and carport.

Natural woods were not only used in the design but also preserved on the site. In placing the house on wood piles, Mr. Morgan reduced the need for earthmoving, making it possible to save most of the trees

For more information on Wolmanized® lumber or Koppers laminated wood beams and decking, check the coupon.

Architect: William Morgan, Jacksonville



#### Fascia panels: 120 pounds each

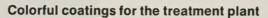


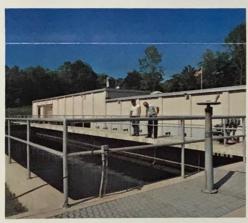
Large, shadow box fascia panels on the new Los Angeles Social Services Building have a substantial look without the weight to match. Each of the 8 by 14 foot panels weighs 120 pounds, light enough to be carried and lifted around the construction site by two workmen. Panels were molded by the Williams-Bermuda Corp. of Alhambra, using Koppers polyester resins reinforced

with fiber glass.

Williams-Bermuda has received Los Angeles building code approval for use of its plastic fire-resistant panels, roof vents, skylights, and duct work. For information, check the coupon.

Architects: Carey K. Jenkins & Associates, Los Angeles





The water treatment plant should treat the water without demanding constant treatment for itself.

So when the Newburgh Consolidated Water District in New York State planned the new Chadwick Lake Treatment Plant, they decided to head off the costs and complications of a heavy maintenance schedule. Throughout the plant, specially formulated Koppers coating systems protect pipe and tank surfaces from corrosion.

Two 6,000 gallon steel tanks to store



sodium hydroxide received a coat of Koppers epoxy primer followed by two coats of an epoxy topcoat. Two 3,000 gallon liquid alum tanks are protected by a coat of Torex® metal primer and three coats of Torex Heavy, a rubber-based system which is unaffected by strong alkali solutions. Exteriors of all four tanks received field coats of rust inhibitive primer No. 622 and two coats of Glamortex® enamel, a high gloss alkyd base paint.

Two colorful coats of Glamortex on interior piping provide not only protection but improved appearance and color coding for ready identification.



The Chadwick Lake plant is the first in the state to be equipped with Automatic Backwash Sand Filters and the first with settling lagoons for sludge disposal.

The filters, supplied by Koppers Hardinge Operation, were chosen because they automate the filtration process, operate in shallow tanks at very low head loss, and provide their own water for backwash cleaning. Check the coupon for details on protective coating systems or Automatic Backwash Filters.





First Class Permit No. 1046 Pittsburgh, Pa.

## BUSINESS REPLY MAIL

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POSTAGE WILL BE PAID BY -

Koppers Company, Inc.

Room 1328, Koppers Building

Pittsburgh, Pennsylvania 15219

Attn: Robert M. Winters, Mgr., Architectural Sales

## Memo

from Robert M. Winters, Manager, Architectural Sales

To:

RHEA FRANK PROJECT DIRECTOR
U 5 TREASURY DEPT
UNITED STATES MINT
320 W COLFAX AVE
DENVER
CO 80204

We are alerting you to the effective design ideas of:

Jorn Utzon

Laminated beams & decking

Wolmanized® lumber & piling

Protective coatings

using Koppers Aircoustat® Sound Traps

William L. Pereira Associates

using Koppers built-up roofing and waterproofing systems

William Morgan

using Wolmanized® lumber and Koppers laminated wood beams & decking

Carey K. Jenkins & Associates

using Koppers fiberglass reinforced polyester resin fascia panels

The Chadwick Lake Treatment Plant

using Koppers protective coatings and Automatic Backwash Filters

**Good Design Works With Koppers Products** 

For more information on Koppers Building Products, detach and return card

Built-up roofing

polyester panels

Fiberglass reinforced

Waterproofing

## Memo

Iroin.		
Name		
Title		
Company		
Address		
	WAR THE RESIDENCE OF THE RESIDENCE	
Please send me additional infor	mation about the products I have chec	cker
Almontoti elleneere	Automatic Backwach Filton	
Aircoustat® silencers	Automatic Backwash Filter	9

I am using Koppers (products)

in my

projects

26 --- 1973

Mr. D. W. Jarke President Jarke Corporation 6333 W. Howard Street Chicago, Illinois 60648

Dear Mr. Jarke:

The descriptive literature furnished by your letter of December 4 has been forwarded to Mr. Frank W. Rhea, Facilities Project Manager, new Denver Mint.

Our current plans are to utilize pallets for storage and shipment of coin bags, similar to the system in operation at the Philadelphia Mint, when the new Denver Mint becomes operational about 1980. Mr. Phea is aware that your equipment is in use at the Philadelphia Mint.

Sincerely,

(Signed) G.G. Ambrose

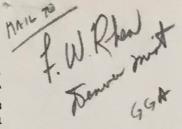
George G. Ambrose Assistant Director for Production

ce: N. Anderson, Philadelphia Mint VF. W. Rhea, Denver Mint



## corporation

6333 W. HOWARD STREET CHICAGO, ILLINOIS 60648 (312) 774-6464 TELEX: 724-401



DALGEROSS Se

Jarke Western Corporation • 603 S. Arrowhead Ave. • San Bernardino, Cal. 92408 • (714) 889-9577

December 4, 1973

This show that for think the standard of the

Mr. George Ambrose, Deputy Director of Production
Bureau of the Mint
Treasury Building
Washington, D.C.

Dear Sir:

Upon the advice of Mr. G. Norman Anderson, I am writing you this letter to offer our services to help with any of your problems in the material handling field. We have been manufacturing the racks that are presently being used by the Mint and by the Federal Reserve Banks. Recently, we have been contacted by some of the larger banks to supply racks to them also.

It has come to my attention that a new Mint is being considered in Denver, and if we can be of any assistance, feel free to contact us. I am taking the liberty of enclosing our descriptive literature on many of our material handling products, and as I mentioned, if we can be of any assistance, please feel free to contact me.

Yours very truly,

JARKE CORPORATION

D. W. Jarke President

DWJ:FB encls.

cc: Mr. G. Norman Anderson U.S. Mint Philadelphia, Pennsylvania JARKE corporation





CATALOG 72



corporation

6333 W. HOWARD STREET CHICAGO, ILLINOIS 60648 (312)-647-9633



# JARKE BUTTON-ON

ADJUSTABLE ARM CANTILEVER RACK

U.S. Patent No. 3,164,255

#### STANDARD LOW-COST DESIGN EVERY PIECE ACCESSIBLE

Load up to 2,000 lbs. at one time with lift-truck. Remove or load piece-by-piece manually, if desired. Also take full or partial loads with lift-truck. With the Jarke Adjustable Cantilever Rack, every piece of stock is instantly accessible.

Standard, single or double column units provide safe, engineered-capacity storage. These free-standing Jarke racks erect in minutes. Stock models have button-on arms that adjust on 4" centers.

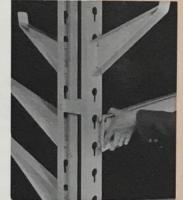
Ideal for maintenance departments, tool rooms . . . for storing turret lathe and screw machine stock.

Lengths, capacities and variations to meet your specific requirements can be supplied. Engineering drawings and quotations supplied without obligation.

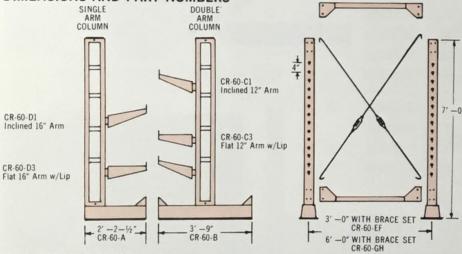


Double column unit with 24 arms. Each arm has 1,000 lb. capacity.

Just "button" arms in position. No nuts or bolts required.



#### DIMENSIONS AND PART NUMBERS



#### ORDER BY NUMBER

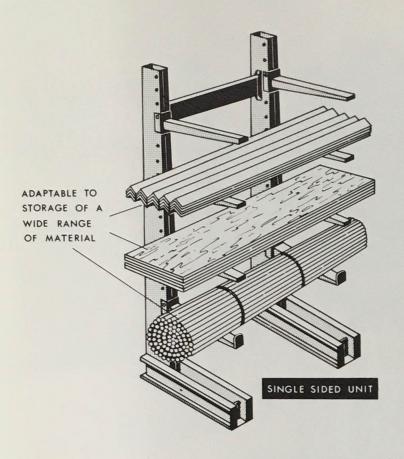
ARM TYPE	12-INCH	16-INCH	BRACE SETS (Complete)
INCLINED ARMS	CR-60-C1	CR-60-D1	3 FT. CR-60-EF
Shipping wt.	4.5 lbs.	6 lbs.	40 lbs.
FLAT ARMS W/LIP	CR-60-C3	CR-60-D3	6 FT. CR-60-GH
Shipping wt.	4.5 lbs.	6 lbs.	70 lbs.

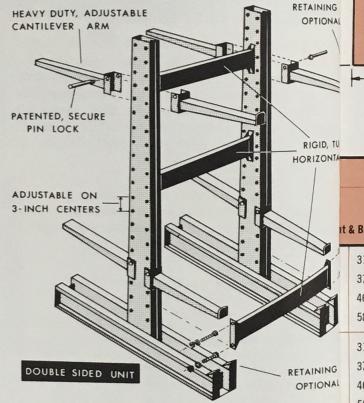
SINGLE ARM COLUMN-CR-60-A 96 lbs

DOUBLE ARM COLUMN-CR-60-B 115 lbs.

Single column unit shown with 12 arms. Each individual arm has 1,000 lb. capacity.







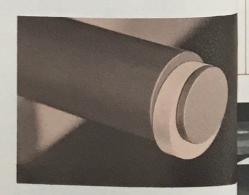
# JARKE **STEELTREE®**

STANDARD SERIES 24 CANTILEVER RACK AND ACCESSORIES

U.S. Patent No. 3,512,654

#### Up to 3,000 lb. Capacity per Arm

Heavy-capacity Jarke Steeltree permits loading to 6,000 lbs. per pair of arms, using lift truck. Arms adjustable on 3-inch centers. Standard, single or double column units available in heights of 8-, 10- or 12-feet with total capacities up to 72,000 lbs. For longer length materials, use side-by-side multiple racks.



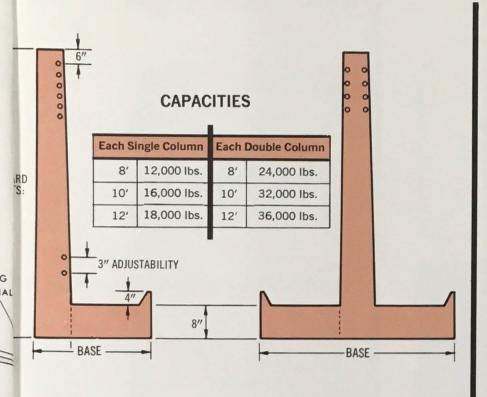
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58

3

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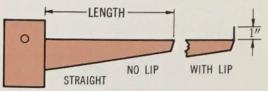
SECURE PIN LOCK permits instant justability of arms. Easily inserted and moved for adjustment of arm height, Ja pin lock cannot work loose in serv



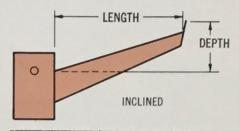
	SINGLE						DOUB	LE	
ght	t & Base	For Arms	Catalog Number	Ship. Wt. Lbs.	Height	& Base	For Arms	Catalog Number	Ship. Wt. Lbs.
8'	31"	12", 18"	24CS31096	155	8′	53"	12", 18"	24CD53096	195
·B1	37"	24"	24CS37096	164	8′	65"	24"	24CD65096	212
8'	46"	30", 36"	24CS46096	182	8′	82"	30", 36"	24CD82096	237
8'	58"	42", 48"	24CS58096	198	8′	106"	42", 48"	24CD106096	277
0'	31"	12", 18"	24CS31120	223	10′	53"	12", 18"	24CD53120	262
)'	37"	24"	24CS37120	232	10′	65"	24"	24CD65120	279
)	46"	30", 36"	24CS46120	249	10′	82"	30", 36"	24CD82120	305
)′	58"	42", 48"	24CS58120	266	10′	106"	42", 48"	24CD106120	345
21	31"	12", 18"	24CS31144	292	12'	53"	12", 18"	24CD53144	331
2'	37"	24"	24CS37144	301	12'	65"	24"	24CD65144	348
2'	46"	30", 36"	24CS46144	318	12'	82"	30", 36"	24CD82144	374
2'	58"	42", 48"	24CS58144	335	12'	106"	42", 48"	24CD106144	414

TUB

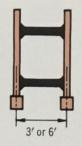
#### STANDARD ARMS



Length	Capacity Per Arm	CATALOG No Lip	NUMBER With Lip	Shipping Wt. Lbs.
12"	3,000 lbs.	24AS012	24ASL12	11
18"	2,500 lbs.	24AS018	24ASL18	13
24"	2,000 lbs.	24AS024	24ASL24	15
30"	1,600 lbs.	24AS030	24ASL30	17
36"	1,300 lbs.	24AS036	24ASL36	20
42"	1,145 lbs.	24AS042	24ASL42	22
48"	1,000 lbs.	24AS048	24ASL48	24



Length	Depth	Capacity Per Arm	Catalog Number	Shipping Wt. Lbs.
12"	5"	3,000 lbs.	24AIL12	12
18"	7"	2,500 lbs.	24AIL18	14
24"	9"	2,000 lbs.	24AIL24	16



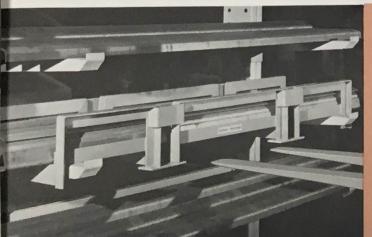
Column Centers	Catalog Number Per Set of 2	Shipping Wt. Lbs.
3′	24B 236	34 Set (2)
6′	24B 272	62 Set (2)

FOR 8' COLUMNS 2 BRACES PER SET

FOR 10' and 12' COLUMNS 3 BRACES PER SET

Column Centers		Catalog Number Per Set of 3	Shipping Wt. Lbs.	
	3′	24B 336	51 Set (3)	
	6'	24B 372	93 Set (3)	





### JARKE QUIKTRAY®

U.S. Patent No. 3,503,515

Bar racks for Jarke Steeltree permit unitized handling of heavy stocks. Design (Patent Pending) permits sling removal or loading of stocks from individual racks, using overhead crane facilities. Fork lifts handle loaded Quiktrays on and off Steeltree arms. Fast, convenient handling of heavy, long, unwieldly stocks. Instant accessibility to one piece or a Quiktray-load.

# JARKE Modular

PORTABLE BAR RACKS



Jarke Flange Rack System permits modular load handling with overhead crane and Flange Grab. Available air space is used for storage, maximizing use of every square foot of floor space.



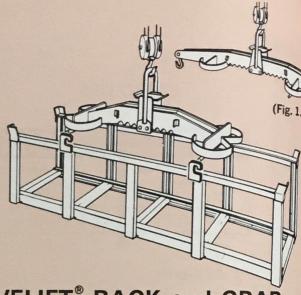
Organization of stocks—and ease of handling modular loads—are keystones of this custom Jarke installation.

Jarke Portable Bar Racks are designed for one-man handling with unit loads, based on crane capacity and operating requirements—regardless of crane device used.

Jarke Portable Bar Racks are rugged, heavy-duty, all-welded steel construction. They are engineered to withstand normal rough handling and to provide years of maintenance-free service. They are designed to stack easily.

Most importantly, Jarke Portable Bar Racks are designed to handle heavy unit loads in perfect safety. Special designs to meet your specific requirements are available without obligation.

# CHOICE OF THR



### LEVELIFT® RACK and GRAB

RACK Hook type standard design (see tables on follow ing pages) for handling with Jarke Levelift® Grab.

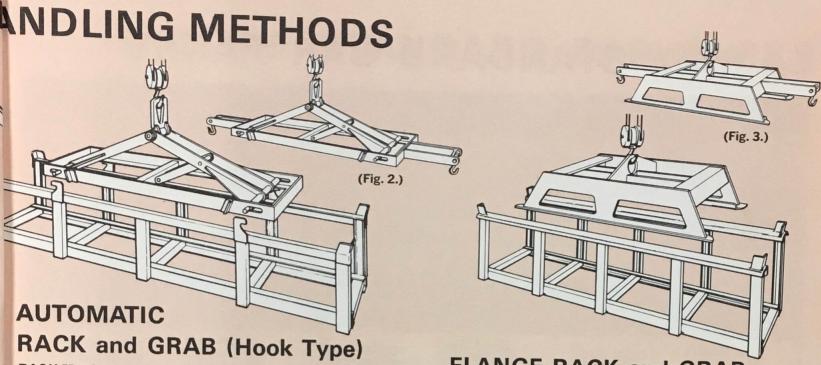
GRAB U. S. Pat. No. 2,905,501 is designed for handling Jarke Levelift® Racks. Specially designed shackle piece permits crane operator to compensate for off-center loads. Safeguards against tipping and stock sliding. Circular fenders provide easy sighting and positioning by crane operator, permit smooth entry into hooks of rack. Optional spreader beam (Fig. 1) available of quotation.

#### WHY THREE BAR RACK STYLES?

Each Jarke Rack and Grab system has been designed for maximumAvefficiency, safety, economy and handling ease. Each type has basisty advantages for particular operating circumstances. A quick chechage of the table below will give you a good idea which system is been for you before you begin to turn to the broad selection of standard terms.

FACTORS	LEVELIFT® RACK	AUTOMATIC RACK	FLANGE RACK
HANDLING	Ideal for cab- controlled crane. Guide- fenders allow "sail-in" grab entry.	For cab- operated crane and monorail crane where maneuverability is limited.	Ideal for floor- controlled crane. Operato has full visibil ity for end entry.
BALANCE	Adjustable.	Not adjustable.	Adjustable.
HEADROOM REQUIRE- MENT			Least.
MULTIPLE LIFTS	Not possible.	Not possible.	Possible. Especially suitable for light metals, tubing, plastic
RACK COST	Approximately the same.		Somewhat more expensive that Levelift and automatic raciabove 10,000 lbs. capacity.
GRAB COST	Approximately the same as flange grab.	Approximately double the Levelift® or	Approximately the same as Levelift® gral

flange grab.



**RACK** Hook type standard design with out-facing hooks to accommodate scissors-action grab. (See tables on following pages for capacities and dimensions.)

**GRAB** Scissors-action grab is engineered to lock into hoist position when lowered over a Jarke Automatic Rack. Optional spreader beam (Fig. 2) available on quotation.

#### ALL BAR RACKS ON THESE PAGES . . .

... are standard designs, with engineered capacities and safety factors for safe, economical handling of bar stocks. They stack 8 high with a full load in each rack. Full selection of standard capacities and dimensions, including Standard Floor Extended models, meet almost every requirement. (See tables on following pages.) Accessories shown below. Special designs to meet any requirement quoted on request.

#### FLANGE RACK and GRAB

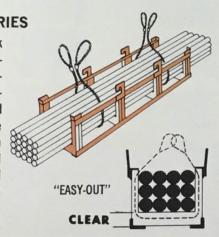
**RACK** Flange top racks permit handling with Jarke Flange Grab (see tables on following pages).

**GRAB** Slides over end of Jarke Flange Rack to make pickup. Easy for crane operator to lift and reset to compensate for unbalanced loads, preventing tipping or stock sliding. With adequate crane capacity, can be designed to lift 2 or more racks at one time (usually used for lightweight metals). Optional spreader beam (Fig. 3) available on quotation.

NOTE: To properly engineer your application for maximum efficiency, racks and grabs must be selected or designed to work with your material and your handling equipment. You may require standard or special accessories or construction details (such as corner gussets) to fully meet your needs. Your Jarke man can assist you with these details.

#### **NEW "EASY-OUT" SERIES**

Available in all three rack styles up to 10,000 lbs. capacity, permit easy sling removal or attachment for materials being removed or loaded into racks. As shown in these drawings, floors are made with angles rather than channel frames, providing side and floor clearance for slings. (See following pages for wide selection of capacities and sizes.)



#### HOW TO ORDER:

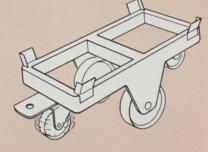
BAR RACKS	Choose catalog number from standard series on following pages.
GRABS	Use matching bar rack number.
GRABS WITH Spreader Beam	All grab styles available with spreader beams in two standard lengths:  8'6" 10'6"  Order by length and rack number.  NOTE: If used for other loads in addition to rack loads, consult factory.

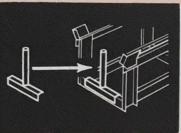
#### TRANSPORT CARTS

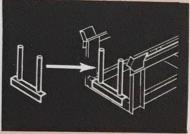
For unit handling of racks and loads when they have been de-stacked by crane and carried to aisle for further transport. • Diamond • 5th Wheel • Double-Articulated • Hand-Pushed • Towed Mechanically

STEEL WHEELS
 PLASTIC

WHEELS • RUBBER WHEELS.







#### REMOVABLE DIVIDERS

Permit handling of split loads in a single rack, thereby utilizing full rack capacity.

Removable steel stack dividers that fit over ends of racks, divide materials into 2 and 3 smaller lots for additional convenience, space saving. (2 required for each rack.)

**LEVELIFT®** AUTOMATIC FLANGE 8 FOOT BAR RACKS WITH "EASY-OUT" FLOOR - TO 6,000 LB. CAPACITY 8' 8'-8' Inside Inside Inside Inside Inside Inside Width, In. Ht., In. Width, In. Ht., In. Width, In. Ht., In. H **Catalog Number** W **Catalog Number** W Catalog Number 16 10 ELV-86-1610 16 10 EAU-86-1610 16 10 EFG-86-1610 16 12 ELV-86-1612 16 12 EAU-86-1612 16 12 16 EFG-86-1612 16 ELV-86-1616 16 16 EAU-86-1616 16 16 EFG-86-1616 18 12 ELV-86-1812 18 12 EAU-86-1812 18 EFG-86-1812 18 15 12 ELV-86-1815 18 15 EAU-86-1815 18 15 18 18 ELV-86-1818 EFG-86-1815 18 18 EAU-86-1818 18 18 EFG-86-1818 24 12 ELV-86-2412 24 12 24 EAU-86-2412 15 24 12 ELV-86-2415 EFG-86-2412 24 15 EAU-86-2415 24 24 18 ELV-86-2418 15 EFG-86-2415 18 EAU-86-2418 24 18 EFG-86-2418 8 FOOT BAR RACKS WITH "EASY-OUT" FLOOR - TO 10,000 LB. CAPACITY 8'-8' 8'-16 10 ELV-810-1610 16 10 16 EAU-810-1610 12 ELV-810-1612 16 16 12 10 16 16 EAU-810-1612 EFG-810-1610 ELV-810-1616 16 16 16 12 EAU-810-1616 EFG-810-1612 16 18 12 16 ELV-810-1812 EFG-810-1616 18 12 18 15 EAU-810-1812 ELV-810-1815 18 15 18 12 18 ELV-810-1818 EAU-810-1815 18 EFG-810-1812 18 18 18 15 EAU-810-1818 EFG-810-1815 24 12 18 18 ELV-810-2412 EFG-810-1818 24 24 12 EAU-810-2412 15 ELV-810-2415 24 15 24 18 EAU-810-2415 ELV-810-2418 12 EFG-810-2412 24 18 24 EAU-810-2418 15 EFG-810-2415 24 18 EFG-810-2418 8 FOOT BAR RACKS WITH STANDARD FLOOR — TO 10,000 LB. CAPACITY 8' 8' 16 8' 10 LV-810-1610 16 10 AU-810-1610 16 12 LV-810-1612 16 12 16 16 LV-810-1616 AU-810-1612 16 16 10 16 FG-810-1610 AU-810-1616 16 12 18 12 LV-810-1812 16 FG-810-1612 18 12 16 AU-810-1812 18 15 LV-810-1815 FG-810-1616 18 15 AU-810-1815 18 18 18 LV-810-1818 18 18 12 AU-810-1818 18 FG-810-1812 15 24 12 FG-810-1815 LV-810-2412 18 24 12 18 AU-810-2412 24 15 LV-810-2415 24 FG-810-1818 15 AU-810-2415 24 18 LV-810-2418 24 18 12 AU-810-2418 24 FG-810-2412 15 24 FG-810-2415 18 FG-810-2418

LE	VEL	IFT®	A	UTO	MATIC		FL	ANGE
<b>«</b> -	10 FO	OT BAR RACKS	WITH	"EASY	-OUT" FLOOR -	TO 6,00	00 LB.	CAPACITY
5	5							
Inside	-10'	<b></b>	Inside	—10'—		Inside	—10'-	
Width, In.	Ht., In.	Catalog Number	Width, In.		Catalog Number	Width, In.	Ht., In.	Catalog Number
16 16 16	10 12 16	ELV-106-1610 ELV-106-1612 ELV-106-1616	16 16 16	10 12 16	EAU-106-1610 EAU-106-1612 EAU-106-1616	16 16 16	10 12 16	EFG-106-1610 EFG-106-1612 EFG-106-1616
18 18 18	12 15 18	ELV-106-1812 ELV-106-1815 ELV-106-1818	18 18 18	12 15 18	EAU-106-1812 EAU-106-1815 EAU-106-1818	18 18 18	12 15 18	EFG-106-1812 EFG-106-1815 EFG-106-1818
24 24 24	12 15 18	ELV-106-2412 ELV-106-2415 ELV-106-2418	24 24 24	12 15 18	EAU-106-2412 EAU-106-2415 EAU-106-2418	24 24 24	12 15 18	EFG-106-2412 EFG-106-2415 EFG-106-2418
	10 FOOT BAR RACKS WITH "EASY-OUT" FLOOR — TO 10,000 LB. CAPACITY							
5	<b>4'</b> →		5	4'—		-		
-	—10'—		-	<u>10'</u> _		-	<u> </u>	
16 16 16	10 12 16	ELV-1010-1610 ELV-1010-1612 ELV-1010-1616	16 16 16	10 12 16	EAU-1010-1610 EAU-1010-1612 EAU-1010-1616	16 16 16	10 12 16	EFG-1010-1610 EFG-1010-1612 EFG-1010-1616
18 18 18	12 15 18	ELV-1010-1812 ELV-1010-1815 ELV-1010-1818	18 18 18	12 15 18	EAU-1010-1812 EAU-1010-1815 EAU-1010-1818	18 18 18	12 15 18	EFG-1010-1812 EFG-1010-1815 EFG-1010-1818
24 24 24	12 15 18	ELV-1010-2412 ELV-1010-2415 ELV-1010-2418	24 24 24	12 15 18	EAU-1010-2412 EAU-1010-2415 EAU-1010-2418	24 24 24	12 15 18	EFG-1010-2412 EFG-1010-2415 EFG-1010-2418
	10 F	OOT BAR RACK	S WITH	STANE	OARD FLOOR —	TO 10,0	00 LB	. CAPACITY
5	4'-	t whi	1	4'_	₩ Ĥ			<del> </del>   <del> </del>
-	—10'—		-	<u> </u>		-	—10'-	
16 16 16	10 12 16	LV-1010-1610 LV-1010-1612 LV-1010-1616	16 16 16	10 12 16	AU-1010-1610 AU-1010-1612 AU-1010-1616	16 16 16	10 12 16	FG-1010-1610 FG-1010-1612 FG-1010-1616
18 18 18	12 15 18	LV-1010-1812 LV-1010-1815 LV-1010-1818	18 18 18	12 15 18	AU-1010-1812 AU-1010-1815 AU-1010-1818	18 18 18	12 15 18	FG-1010-1812 FG-1010-1815 FG-1010-1818
24 24 24 24	12 15 18	LV-1010-2412 LV-1010-2415 LV-1010-2418	24 24 24	12 15 18	AU-1010-2412 AU-1010-2415 AU-1010-2418	24 24 24	12 15 18	FG-1010-2412 FG-1010-2415 FG-1010-2418

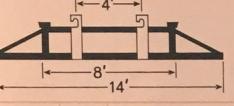
**LEVELIFT®** AUTOMATIC FLANGE 10 FOOT BAR RACKS WITH STANDARD FLOOR — TO 15,000 LB. CAPACITY 5'--W 10' 10' 10' Inside Inside Inside Inside Inside Inside Width, In. Ht., In. Width, In. Ht., In. Width, In. Ht., In. W H **Catalog Number Catalog Number** Н Catalog Number 16 10 LV-1015-1610 16 10 AU-1015-1610 16 10 FG-1015-1610 16 12 LV-1015-1612 16 12 AU-1015-1612 16 12 FG-1015-1612 16 16 LV-1015-1616 16 16 AU-1015-1616 16 16 FG-1015-1616 18 12 LV-1015-1812 18 12 AU-1015-1812 18 12 FG-1015-1812 18 15 LV-1015-1815 18 15 AU-1015-1815 18 15 FG-1015-1815 18 18 LV-1015-1818 18 18 AU-1015-1818 18 18 FG-1015-1818 24 12 LV-1015-2412 24 12 AU-1015-2412 24 12 24 FG-1015-2412 15 LV-1015-2415 24 15 AU-1015-2415 24 FG-1015-2415 15 24 18 LV-1015-2418 24 18 AU-1015-2418 24 18 FG-1015-2418 10 FOOT BAR RACKS WITH STANDARD FLOOR — TO 25,000 LB. CAPACITY -5'--10' -10" 18 12 LV-1025-1812 18 12 AU-1025-1812 18 15 LV-1025-1815 18 15 18 18 AU-1025-1815 LV-1025-1818 18 18 AU-1025-1818 24 12 LV-1025-2412 24 12 ON APPLICATION 24 AU-1025-2412 15 LV-1025-2415 24 15 AU-1025-2415 24 18 LV-1025-2418 24 18 AU-1025-2418 14 FOOT BAR RACKS — STANDARD FLOOR EXTENDED — TO 10,000 LB. CAPACITY 8--8'--14'--14'-8 14'-18 12 LV-1410-1812 18 12 AU-1410-1812 18 15 LV-1410-1815 18 15 18 AU-1410-1815 12 18 18 LV-1410-1818 FG-1410-1812 18 18 18 AU-1410-1818 15 FG-1410-1815 24 12 LV-1410-2412 18 24 18 12 FG-1410-1818 AU-1410-2412 24 15 LV-1410-2415 24 15 24 AU-1410-2415 12 LV-1410-2418 24 18 FG-1410-2412 24 18 AU-1410-2418 24 15 FG-1410-2415 24 18 FG-1410-2418

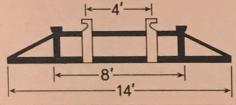
#### **LEVELIFT®**

#### **AUTOMATIC**

#### **FLANGE**

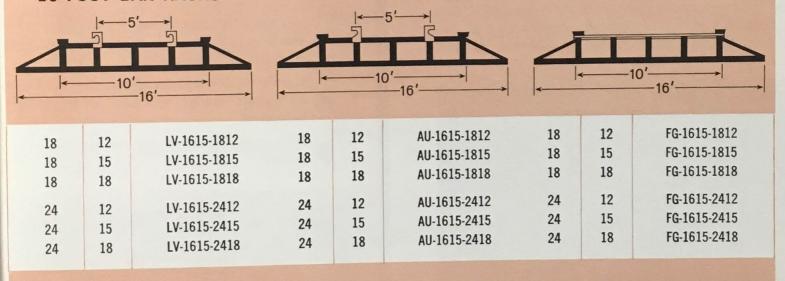
14 FOOT BAR RACKS — STANDARD FLOOR EXTENDED — TO 20,000 LB. CAPACITY



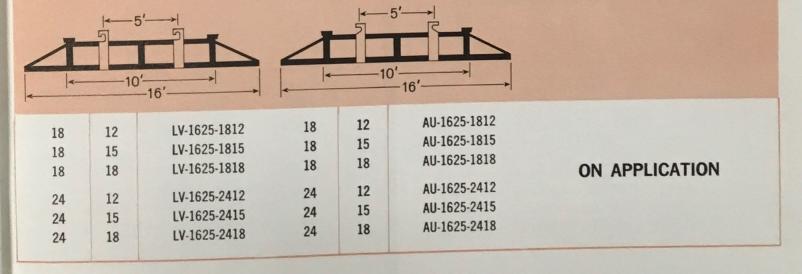


	Inside Inside Width, In. Ht., In. W H	Catalog Number	Inside Ht., In. H	Inside Width, In. W	Catalog Number	Inside Ht., In. H	Inside Width, In. W
		AU-1420-1812	12	18	LV-1420-1812	12	18
		AU-1420-1815	15	18	LV-1420-1815	15	18
APPLICATION	ON ADI	AU-1420-1818	18	18	LV-1420-1818	18	18
APPLICATION	UN API	AU-1420-2412	12	24	LV-1420-2412	12	24
		AU-1420-2415	15	24	LV-1420-2415	15	24
		AU-1420-2418	18	24	LV-1420-2418	18	24

#### 16 FOOT BAR RACKS — STANDARD FLOOR EXTENDED — TO 15,000 LB. CAPACITY



### 16 FOOT BAR RACKS — STANDARD FLOOR EXTENDED — TO 25,000 LB. CAPACITY



#### JARKE

MINI-MODULE (U.S. PATENT NO. 2801752

PREFABRICATED STOCK STORAGE RACKS

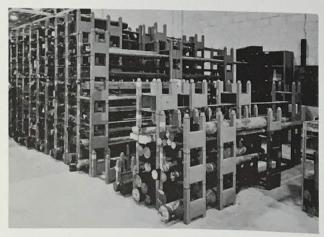


Efficient, low-cost Jarke Mini-Modules take only minutes for one man to set up. Sturdy, yet lightweight and easy to handle, they provide a highly flexible storage system for all types of materials. Jarke Mini-Module installations are expandable in width, height and length. They are readily shifted to meet changing storage requirements.

Materials stored in Jarke Mini-Modules are accessible as individual pieces. Removal is fast and convenient. Cut-off lengths can be returned to storage and quickly identified next time needed.

Simply stack up Jarke Mini-Modules to the depth, height and width you require for space-saving economical storage.

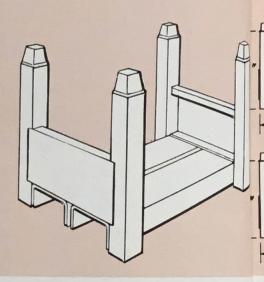
Jarke Mini-Modules are heavy-duty welded steel construction. No bolts, no tools, no fittings are required in set-up or take-down.



# VARIATIONS AND SPECIAL APPLICATIONS QUOTED ON REQUEST

Basic "Mini-Module" design is so simple—so flexible—it can readily be modified to meet almost any specific requirements. Some of the variations we have supplied include special floors for irregular shapes, such as transmissions and housings; units for fork truck handling with short parts; and many others. SPECIALS DESIGNED AND QUOTED AT NO OBLIGATION. Whatever your storage problem, our engineers will help you.

# SINGLE COMPARTM MINI-MODUS

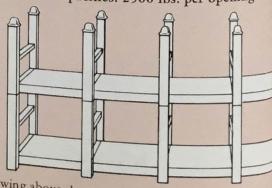


#### **HOW TO ORDER:**

- See specification above showing standar available. Choose the "Mini-Module" univour storage requirements.
- Use the illustration at right to determine the of Module "stacks" you need for length of be stored.
- Sizes and capacities not shown above quest.

# SIZE A MULTIPLE-SECT

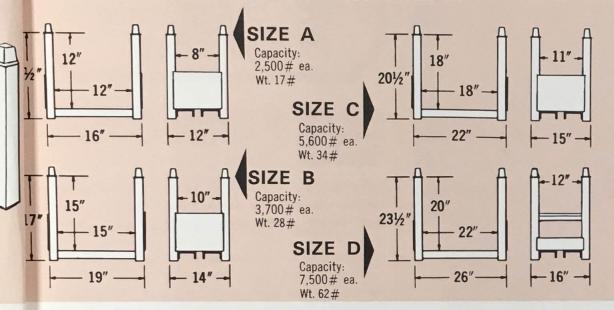
Capacities: 2500 lbs. per opening.



Drawing above shows a 4-section unit with a similar upon top of it. Note how elimination of posts reduces over Solid base provides additional rigidity. Available in similar upon top of it.

## STANDARD SIZES AND CAPACITIES

STANDARD SIZES SHOWN BELOW



#### REMOVABLE SHELVES AND 4-WAY DIVIDERS AVAILABLE FOR ALL BASIC SIZES:

\*Size A takes SA Shelf SVA 4-Way Divider

Size BS takes SB Shelf SVB 4-Way Divider

Size CS takes SC Shelf SVC 4-Way Divider

\*Size D takes SD Shelf SVD 4-Way Divider

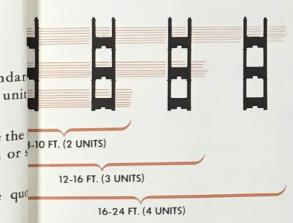
\*Size A and Size D units will accept shelves. B and C units must be ordered as BS and CS units to accept shelves.



SHELF divides full capacity into 2 sections.



4-WAY DIVIDER divides full capacity into



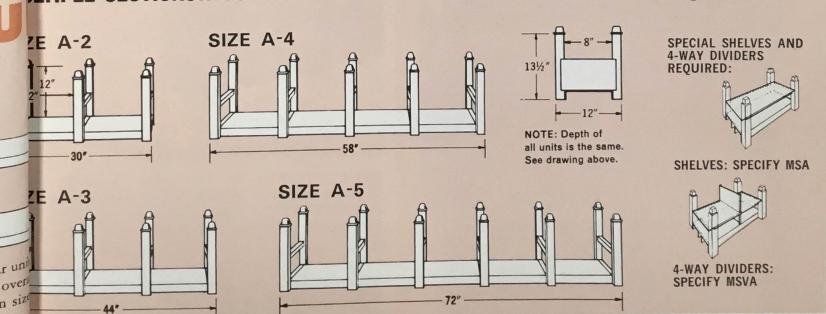
#### CAPACITIES

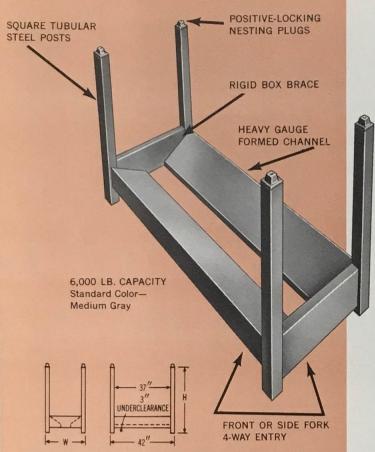
NOTE: Total capacity of a "layer" equals individual capacity multiplied by the number of "Mini-Modules" in each layer.

EXAMPLE: Two size A "Mini-Modules" used to support 8-10 ft. bars will have a capacity of 2,500 lbs. x 2 equals 5,000 lbs. total. 8-10 "layers" high, each fully loaded is standard practice.

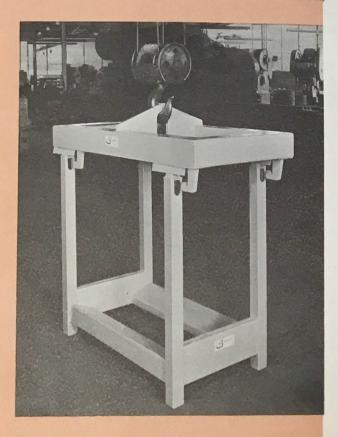
(Same applies to Multiple Sections)

### ILTIPLE SECTIONS...COMMON POST CONSTRUCTION...LESS SPACE REQUIRED





Rack Model No.	For Coil Diameter	W Width	H Height	Shipping Weight, Ibs.
SR-501	24"-28"	20"	34"	104
SR-502	29"-32"	22"	38"	113
SR-503	33"-36"	24"	41"	121
SR-504	37"-42"	26"	47"	135



### JARKE

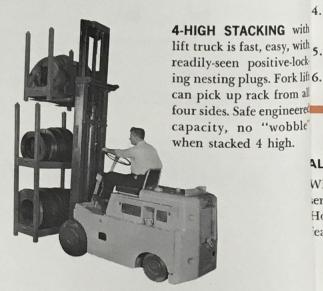
PORTABLE RACKS FOR COILED STRIP OR WIRE COILS

SPEED STRIP COIL HANDLING . PROTECT FINISH NO AND EDGES • PREVENT ELONGATION AND organic "SOUASHING" OF COILS.

Jarke Modular Portable Racks for coiled strip mak cra for fast, efficient, low-cost handling. Engineered stall Ra dard design assures maximum safety with capacit loads. 4-high stacking Racks may be loaded to ful capacity with a ramshorn lift truck, and/or "C" Hook

When loaded, these heavy-duty Jarke Racks an handled as unit loads, with 4-way accessibility by for 1. lift truck. At slight extra charge, racks may be modified for handling with overhead crane in conjunction 2. with the Jarke 4-Point Grab.

Heavier units quoted on request.



AL W er He ez

# FOR OVERHEAD CRANE HANDLING

Standard Jarke Racks for either coiled strip or wire coils can be equipped with "Hook Slots" at slight extra charge for handling by overhead crane in conjunction with Jarke 4-point Crane Grab. This system permitsoverhead "spotting" of loads at production points saves broad aisle space required by load-carrying lift trucks. At same time, modified racks are readily handled by fork lifts, with 4-way entry, affording maximum utilization in plant having overhead cranes.

PAGE 14

### JARKE

# PORTABLE RACKS FOR WIRE COILS

Neat, efficient wire coil storage saves time, money and space in your plant. Jarke Portable Racks make coil storage an organized, efficient, one-man procedure. At slight extra charge, racks may be modified for handling with overhead crane, with Jarke 4-Point Grab, as shown with Coiled Strip Racks.

# HERE ARE A FEW WAYS THESE JARKE UNITS MAKE WIRE COIL HANDLING MORE EFFICIENT:

1. Storage in less space-safely.

SH

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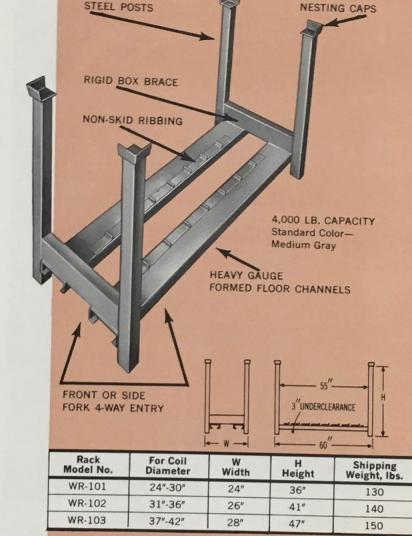
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k.

- 2. Every coil is readily available for quick and easy handling by fork truck or overhead crane (with Jarke 4-Point Grab).
- 3. Front and side fork entry permits closer stacking.
- 4. Eliminates damaged coil . . . costly inspection . . . unnecessary scrap.
- 5. Simplifies inventory control.
- 6. Drastically reduces coil wire handling costs.

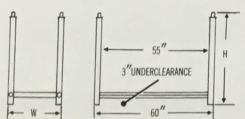


WIDE FLARE

SQUARE TUBULAR

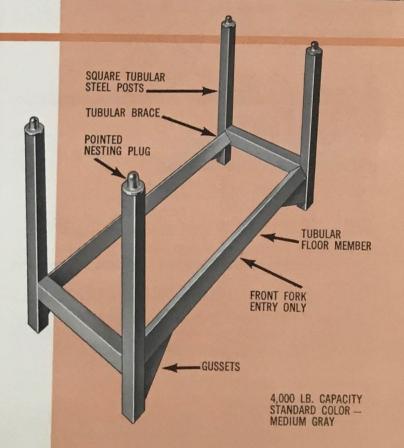
#### ALL TUBULAR WIRE COIL RACK

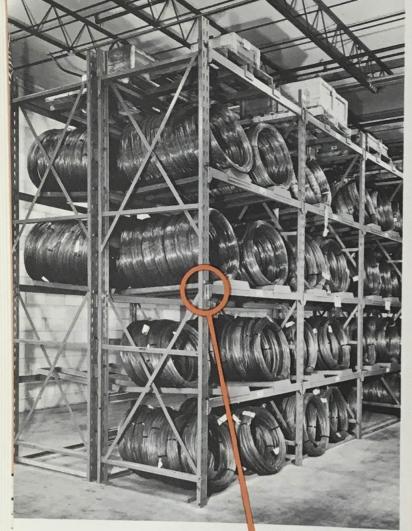
Where 4-way entry is not required, this all-tubular series provides storage planning at a saving in cost. Hook slots and ribbing are also available as optional features.



Rack Model No.	For Coil Diameter	W Width	H Height	Shipping Wt. Lbs.
TW-2428	24"-28"	20"	33"	103
TW-2933	29"-33"	22"	371/2"	111
TW-3438	34"-38"	24"	421/2"	118
TW-3943	39"-43"	26"	471/2"	128
TW-4448	44"-48"	28"	53"	136

Floor ribbing available for slight extra charge.





U.S. Patent No. 3,195,735

The column with the natural impact corners . . . up to six times the thickness of rolled steel columns.

### JARKE UTILItier°

**ALL-PURPOSE STORAGE RACKS** 

Jarke UTILItier is the answer to efficient multiple-purpose storage. Flexible design lets you build storage facilities to your exact space requirements, whether you need just a few bays or a complete warehouse.

Jarke UTILItier racks require no nuts, bolts or screws. Fully adjustable for changing requirements, they lock together quickly and easily. Special Beam Locks give protection from bumping and jarring by fork-lift trucks. Once erected, they are rigid, stable and safe.

Rugged Jarke construction exceed both RMI (Rack Manufacturers Institute) and AISC (American Institute of Steel Construction) specifications.

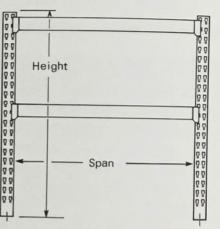
Available in standard or heavy-duty constructions. Special applications requiring design modifications are welcomed.

### NEW HIGH STRENGTH ST

#### JARKE

# **UTILItier**<sup>®</sup>

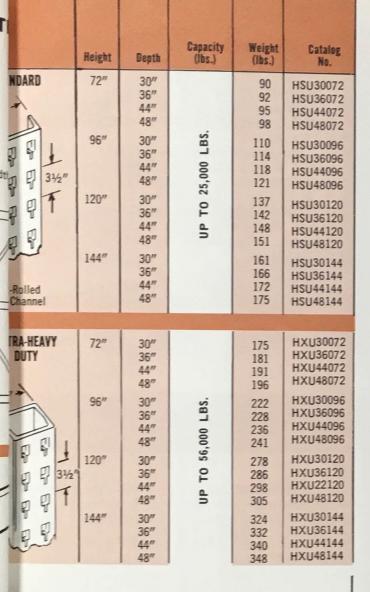
**FRAMES** 





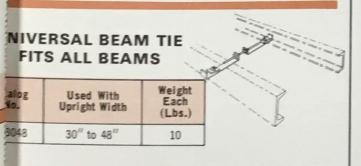
Nominal Length (Clear Span Between Uprights	Capacity Per Pair (lbs.)	Catalog No.	
3-Inc	h Beams (Hi-S	trength Steel)	
46" 54" 70" 82" 90"	12,570 11,480 9,780 7,545 6,000 5,870	H-30C042 H-30C046 H-30C054 H-30C070 H-30C082 H-30C090	
94" 106"	4,500	H-30C094	l
120" 144"	3,630 3,050 2,150	H-30C106 H-30C120 H-30C144	
4-Inch	Beams (Hi-St	rength Steel	-
46" 54" 70" 82" 90" 94" 106" 120"	19,545 17,845 15,200 11,725 10,010 9,120 8,735 7,600 6,840	H-40C042 H-40C046 H-40C054 H-40C070 H-40C082 H-40C090 H-40C106 H-40C120	
46"	ams (Standard	H-40C144 Strength Steel)	
54" 70" 82" 90" 94" 106"	20,250 19,200 14,810 12,645 11,520 11,030 9,780	50C046 50C054 50C070 50C082 50C090 50C094	

Beams in shaded section require universal beam tie.

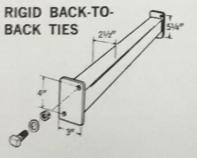


### TRKE UTILITIET CONSTRUCTION

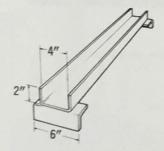
Jarke Utilitier offers expanded construction utility rew, high strength steel sections . . . providing inded capacities for beams and uprights.



AF.	Length	Weight Lbs.
1	4"	3
4 6	6"	4
	8"	4
10	10"	5
12	12"	6



### JARKE UTILITIER® ACCESSORIES

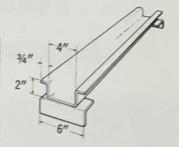


#### STANDARD DROP-IN SKID SUPPORTS

Catalog No.	Used With Upright Depth	Capacity Each	Weight Lbs.
\$\$30	30"	1520	14
\$\$36	36"	1270	17
SS44	44"	1035	20
SS48	48"	950	22

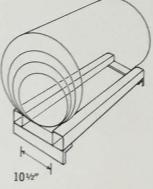
### HEAVY-DUTY DROP-IN SKID SUPPORTS

Catalog No.	Used With Upright Depth	Capacity Each	Weight Lbs.
SH30	30"	3125	16
SH36	36"	2600	19
SH44	44"	2130	23
SH48	48"	1950	25



DROP-IN COIL and/or DRUM CRADLES For Wire, Strip or any other cylindrical load

Catalog No.	Used With Upright Depth	Capacity Each	Weight Lbs.
BC30	30"	3800	16
BC36	36"	2700	19
BC44	44"	2600	22
BC48	48"	2350	23



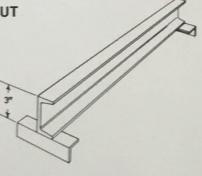


Approximately 200# per sq. ft. Capacity for numbers listed. (Additional capacities and sizes on request).

Catalog No.	Used With Upright Depth	Weight Lbs.
DD30094	30"	108
DD36094	36"	129
DD44094	44"	156
DD48094	48"	170

#### FORK TRUCK CLEARANCE STRUT

Catalog No.	Used With Upright Depth	Capacity Each Lbs.	Weight Each Lbs.
F\$30	30"	3000	12
FS36	36"	2525	14
FS44	44"	2050	17
FS48	48"	1900	18



### JARKE

# AIRECTOR®

## STANDARD SERIES STACKING RACKS

Capacities up to 4,000 Lbs.

Jarke Airector\* Stacking Racks eliminate New pallets, provide all the advantages of safe, estacking storage. Standard units are designed for stacking with full capacity loads.

When stacked, Jarke Airector\* Stacking Rack both rigid and solid, providing maximum safety to

Designed for fork-lift handling exclusively, Jarke tor\* Stacking Racks offer maximum flexibility in s and handling of unitized loads, with maximum acce ity for flow of regular in-production materials. A range of standard wood decked bases, with full tion of clearance heights in both post sets and frames, make selection easy for almost every har requirement.

#### NOTE:

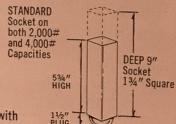
- 1. STANDARD SERIES IN WOOD, STEEL OPEN DECK.
- 2. SPECIAL DESIGNS AND QUOTED ON REQUEST.

\*T.M. REG U.S. PAT. OFF.

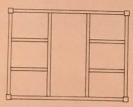
TWO RACK BASES - 2,000 lbs. to 4.000 lbs. Capacities.



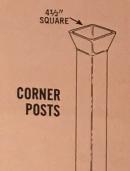
SPECIAL DEEP CORNER SOCKETS



BASE FRAME TYPE BA — Designed with two center support angles for four-way entry by lift truck.

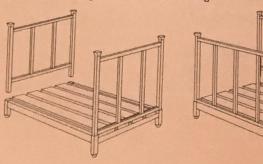


BASE FRAME TYPE BB - Has six center supports for four-way entry by lift trucks having forks shorter than the width of the rack.



#### INTERCHANGEABLE REMOVABLE END OR SIDE FRAMES . . . 2,000 LBS. and 4,000 LBS. SERIES

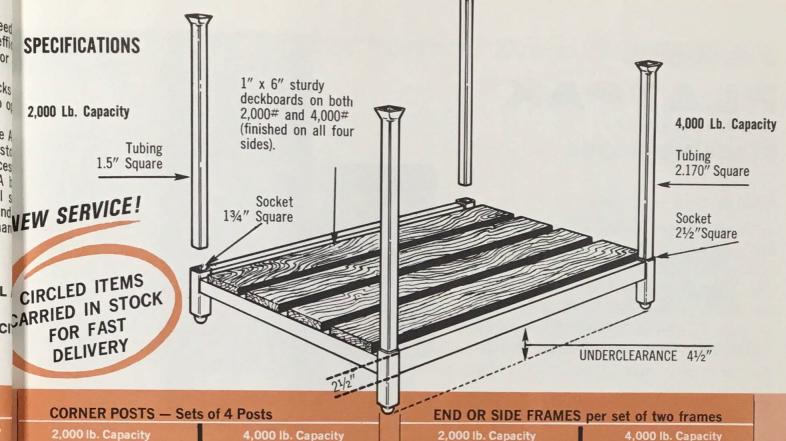
AlRector\* flexibility meets your changing storage requirements! Interchangeable, removable supports provide extra stability . . . prevents shifting . . . eliminate damage.



#### AIRECTOR BASES - 2 WAY 4,000 lb. Capacity EA. NUMBER WIDTH LENGTH LBS. NUMBER WIDTH LENGTH BA-2-3042 30" 42" 48 BA-4-3042 30" 42" BA-2-3048 30" 48" 53 BA-4-3048 30" 48" BA-2-3054 30" 54" 58 BA-4-3054 54" 30" BA-2-3060 30" 60" 68 BA-4-3060 30" 60" BA-2-3642 36" 4211 55 BA-4-3642 42" 36" BA-2-3648 36" 48" 62 BA-4-3648 48" 36" BA-2-3654 36" 54" 68 BA-4-3654 36" 54" BA-2-3660 36" 60" 80 BA-4-3660 60" 36" BA-2-4242 42" 4211 64 42" BA-4-4242 42" BA-2-4248 42" 48" 70 48" BA-4-4248 42" BA-2-4254 4211 54" 76 BA-4-4254 54" 42" BA-2-4260 42" 60" 88 60" BA-4-4260 42" BA-2-4848 48" 48" 79 BA-4-4848 48" 48" BA-2-4854 48" 54" 86 54" BA-4-4854 BA-2-4860 48" 48" 60" 99 BA-4-4860 60" 48"

#### BASES - 4 WAY BB-2-4242 42" 42" 72 BB-2-4248T BB-4-4242 42" 4211 42" 48" 80 BB-2-4254 BB-4-4248 42" 48" 4211 54" 87 BB-2-4260 BB-4-4254 54" 42" 42" 60" 101 BB-4-4260 42" 60" BB-2-4848 487 48" BB-2-4854 89 BB-4-4848 48" 48" 48" 54" BB-2-4860 97 BB-4-4854 48" 48" 54" 60" 112 BB-4-4860

† Circled "FAST-DELIVERY" bases come equipped with



	CURNER PUSIS — Sets of 4 Posts						
The same	2,00	0 lb. Capaci	ty	4,00	0 lb. Capac	ity	
ı		HEIGHT	WEIGHT		HEIGHT	WEIGHT	
ı		ABOVE	LBS.		ABOVE	LBS.	
	NUMBER	DECKBOARDS	PER SET	NUMBER	DECKBOARDS	PER SET	
	PT-2-16	16"	17.0	PT-4-16	16"	26.5	
ı	PT-2-17	17"	17.7	PT-4-17	17"	27.7	
	PT-2-18	18"	18.3	PT-4-18	18"	28.4	
	PT-2-19	19"	19.0	PT-4-19	19"	29.4	
	PT-2-20	20"	19.5	PT-4-20	20"	30.4	
	PT-2-21	21"	20.0	PT-4-21	21"	31.3	
	PT-2-22	22"	20.8	PT-4-22	22"	32.3	
	PT-2-23	23"	21.4	PT-4-23	23"	33.3	
1	PT-2-24	24"	22.0	PT-4-24	24"	34.3	
	PT-2-25	25"	22.5	PT-4-25	25"	35.1	
	PT-2-26	26"	23.0	PT-4-26	26"	36.3	
	PT-2-27	27"	23.5	PT-4-27	27"	37.2	
	PT-2-28	28"	24.0	PT-4-28	28"	38.2	
	PT-2-29	29"	25.0	PT-4-29	29"	39.2	
	PT-2-30	30"	26.0	PT-4-30	30"	40.1	
1	PT-2-31	31"	27.0	PT-4-31	31"	41.1	
	PT-2-32	32"	27.5	PT-4-32	32"	42.1	
	PT-2-33	33"	28.0	PT-4-33	33"	43.0	
	PT-2-34	34"	28.5	PT-4-34	34"	44.0	
	PT-2-35	35"	29.0	PT-4-35	35"	45.0	
	PT-2-36	36"	30.0	PT-4-36	36"	46.0	
	PT-2-37	37"	30.5	PT-4-37	37"	47.0	
	PT-2-38	38"	31.0	PT-4-38	38"	48.0	
	PT-2-39	39"	31.5	PT-4-39	39"	49.0	
	PT-2-40	40"	32.0	PT-4-40	40"	49.8	
	PT-2-41	41"	32.5	PT-4-41	41"	50.9	
	PT-2-42*	100	33.0	PT-4-42*	42"	51.8	
	PT-2-43*	43"	33.5	PT-4-43*	43"	52.8	
	PT-2-44*	44"	34.0	PT-4-44*	44"	53.8	
	PT-2-45*	45"	34.5	PT-4-45*	45"	54.8	
	PT-2-46*	46"	35.0	PT-4-46*	46"	55.8	
	PT-2-47*	47"	35.5	PT-4-47*	47"	56.8	
	PT-2-48*	48"	36.0	PT-4-48*	48"	57.8	
	*Cnools.					with	

\*Specify special deep corner sockets for added stability with posts 42" or longer.

2 000 th Consider		THE RESERVE TO SHARE THE PARTY OF THE PARTY	THE PARTY OF	CHARLES SHOWING	SALES OF THE OWNER,			
	2,000 lb. Capacity			4,00	00 lb. C	apacity		
	NUMBER	WIDTH OR LENGTH	HEIGHT ABOVE DECK- BOARDS	WT. LBS. PER SET	NUMBER	WIDTH OR LENGTH	HEIGHT ABOVE DECK- BOARDS	WT. LBS. PER SET
1	FT-2-3024	30"	24"	36	FT-4-3024	30"	24"	56
	FT-2-3030	30"	30"	41	FT-4-3030	30"	30"	63
	FT-2-3036	30"	36"	47	FT-4-3036	30"	36"	71
	FT-2-3042	30"	42"	51	FT-4-3042	30"	42"	78
	FT-2-3048	30"	48"	55	FT-4-3048	30"	48"	86
-	FT-2-3624	36"	24"	38	FT-4-3624	36"	24"	59
	FT-2-3630	36"	30"	42	FT-4-3630	36"	30"	66
	FT-2-3636	36"	36"	48	FT-4-3636	36"	36"	74
	FT-2-3642	36"	42"	52	FT-4-3642	36"	42"	81
	FT-2-3648	36"	48"	56	FT-4-3648	36"	48"	89
1	FT-2-4224	42"	24"	42	FT-4-4224	42"	24"	67
	FT-2-4230	42"	30"	48	FT-4-4230	42"	30"	75
	FT-2-4236	42"	36"	54	FT-4-4236	42"	36"	84
١	FT-2-4242	42"	42"	59	FT-4-4242	42"	42"	95
	FT-2-4248	42"	48"	61	FT-4-4248	42"	48"	101
1	FT-2-4824	48"	24"	45	FT-4-4824	48"	24"	71
ı	FT-2-4830	48"	30"	48	FT-4-4830	48"	30"	79
1	FT-2-4836	48"	36"	54	FT-4-4836	48"	36"	88
ı	FT-2-4842	48"	42"	59	FT-4-4842	48"	42"	99
	FT-2-4848	48"	48"	64	FT-4-4848	48"	48"	105
1	FT-2-5424	54"	24"	49	FT-4-5424	54"	24"	77
ı	FT-2-5430	54"	30"	56	FT-4-5430	54"	30"	87
	FT-2-5436	54"	36"	62	FT-4-5436	54"	36"	96
	FT-2-5442	54"	42"	68	FT-4-5442	54"	42"	105
	FT-2-5448	54"	48"	73	FT-4-5448	54"	48"	114
1	FT-2-6024	60"	24"	51	FT-4-6024	60"	24"	81
	FT-2-6030	60"	30"	58	FT-4-6030	60"	30"	91
	FT-2-6036	60"	36"	64	FT-4-6036	60"	36"	100
	FT-2-6042	60"	42"	70	FT-4-6042	60"	42"	109
	FT-2-6048	60"	48"	75	FT-4-6048	60"	48"	118
П	- Paul Tribula.		and the same of	Name and Address of the Owner, where the			ASSESSMENT OF THE PARTY OF THE	-

#### JARKE

### **FLATPAK®**

U.S. Patent No. 3,565,018

#### STACKING RACKS

#### 2,000 Or 4,000 Lb. Capacities

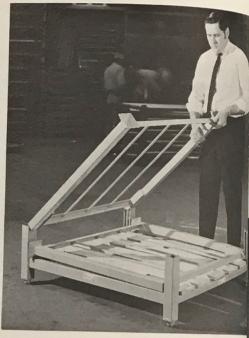
An Airector variation, ideal for transport — folds flat, can't lose end frames, stacks 6 high at full capacity, also stacks when folded flat. Unique lock (Pats. Applied For) locks end frames when folded flat, yet permits quick, easy end frame removal without tools. No slots or holes weaken legs. Racks at capacity stand safely firm and secure. Special designs on request.



**Fully Unfolded** 

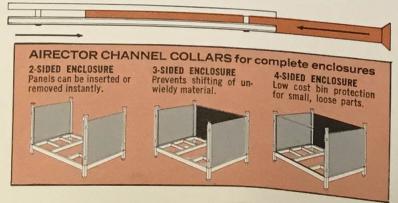


Folded Flat





Independent channel collar assembly slips over base of each leg as shown below. Fit is snug for security. Collars may be removed if desired.



# AIRECTO CHANNEL COLLAR

(OPTIONAL ATTACHME

This versatile, low-cost assembly slips on corner p ... makes possible both side and end closures — as as four-sided enclosures.

Use of both side and end panels converts the AIRect into a complete four-sided storage enclosure. Side of panels alone, or in combination, provides a variety of closure arrangements to suit your storage requiremed Panels can be supplied by Jarke, or they can be a quickly out of steel, wood, or fiber board. Verse AIRector® enables you to adjust to all changing storage.

	CHANNEL COLLARS						
2,0	00 lb. Capa	4,000 lb. Capacity					
Number	Used With Post Length	Weight Lbs. Set of 4	Number	Used With Post Length	Weight Set f		
CC-2-16 CC-2-18 CC-2-20 CC-2-22 CC-2-24	16" 18" 20" 22" 24"	10.6 11.4 12.6 13.9	CC-4-16 CC-4-18 CC-4-20 CC-4-22	16" 18" 20" 22"	12 13 14 16		
CC-2-26 CC-2-28 CC-2-30 CC-2-32 CC-2-34	26" 28" 30" 32" 34"	15.2 17.0 18.6 19.6 20.7 22.1	CC-4-24 CC-4-26 CC-4-28 CC-4-30 CC-4-32	24" 26" 28" 30" 32"	17. 19. 20. 21. 22.		
CC-2-36 CC-2-38 CC-2-40 CC-2-42 CC-2-44	36" 38" 40" 42" 44"	23.2 24.4 25.7 27.0 28.0	CC-4-34 CC-4-36 CC-4-38 CC-4-40 CC-4-42 CC-4-44	34" 36" 38" 40" 42"	25 26 27 29 30		
CC-2-46 CC-2-48	46" 48"	29.4 30.8	CC-4-46 CC-4-48	44"	31.1		

# New Space-Saving Vertical Drum Storage

# ARKE

# M-DNUM-55

U.S. Patent No. 3,476,260



- ALL-WELDED CONSTRUCTION
- READY FOR INSTANT USE—NO SETUP OR BOLTING TOGETHER
- STACKS DRUMS 8 HIGH
- 4-WAY ACCESS BY LIFT TRUCK
- ONE-TRUCK SYSTEM

# Speed Drum Handling and Storage with Multiple-Drum Lifts and Stacking

New Jarke HI-DRUM-55 offers safe, economical storage of 55-gallon drums. This new rack is of welded construction, assembled and painted gray, ready for use. Each unit has a capacity of 1500 lbs., handles two drums, and can be stacked eight high. Weight per unit is 55 lbs.

Jarke HI-DRUM-55 provides fork entry clearances on four sides for maximum maneuverability. Drums can be loaded or unloaded individually, without special handling attachments.

Jarke HI-DRUM-55 assures rapid inventory flow, utilizing a one-truck system.

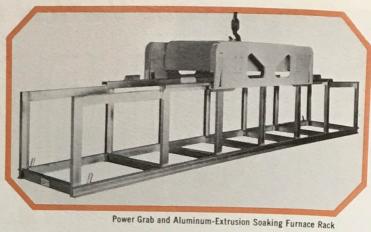






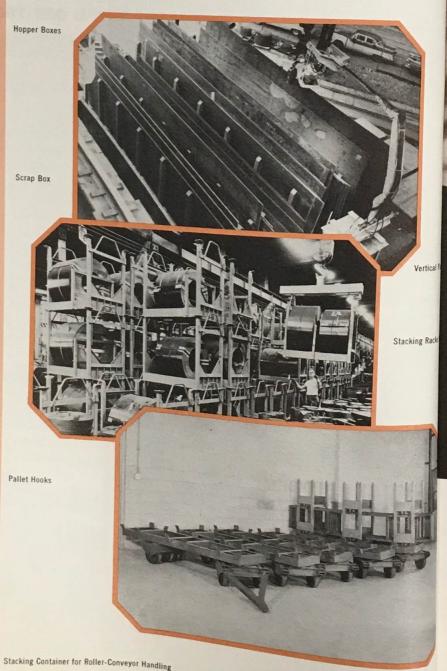


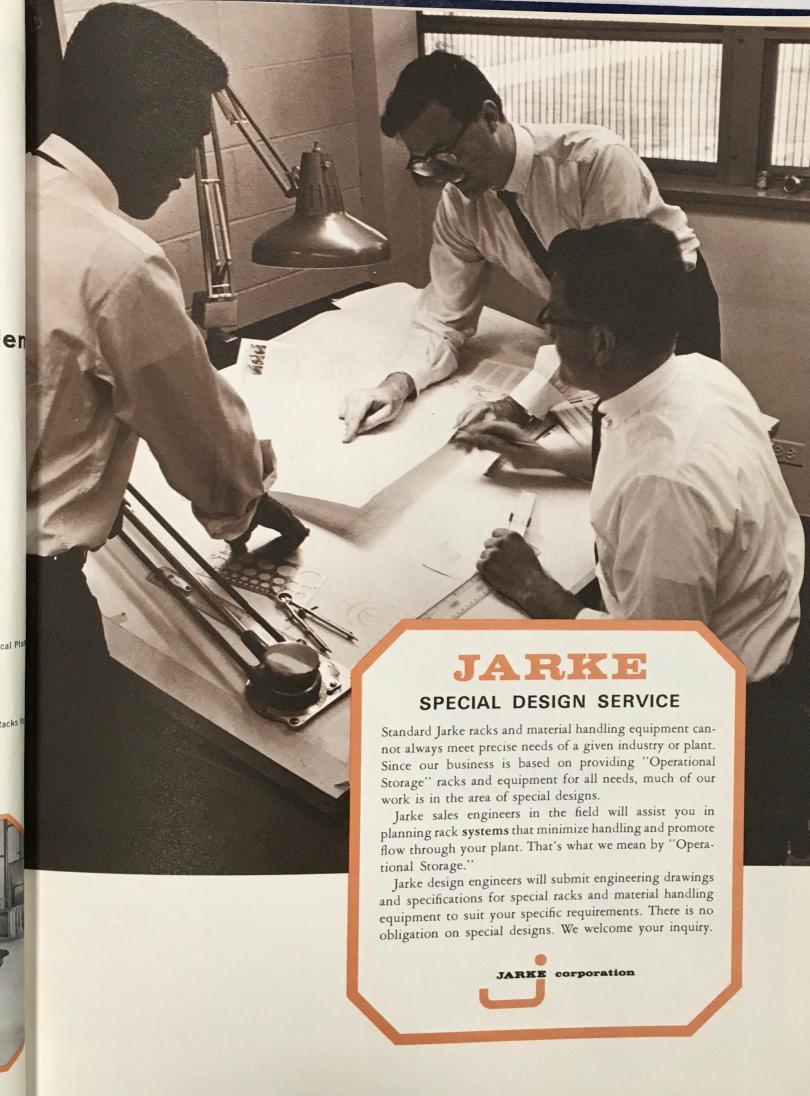




### JARKE

where ideas solve special proble





HI-DRUM drum racks

STEELTREE

cantilever racks

MINI-MODULE

prefabricated storage racks

**AIRECTOR** 

UTILITIER

stacking racks

storage racks

portable racks for coiled strip or wire coil

modular portable bar racks



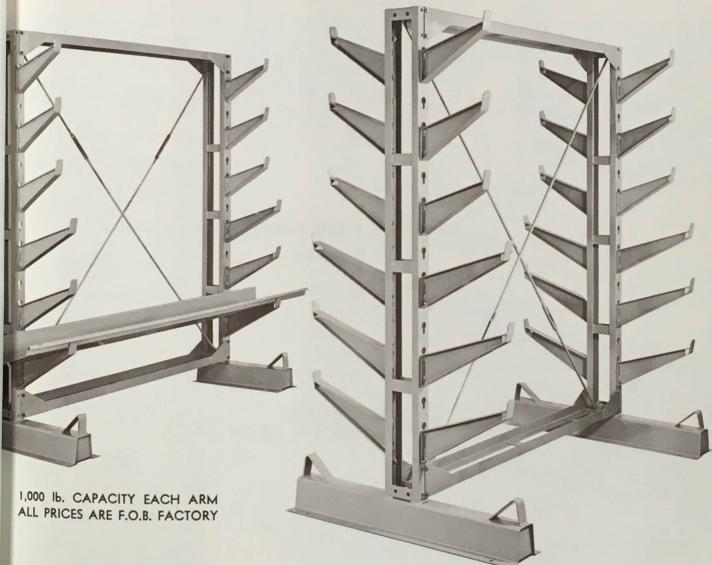
"BUTTON-ON"

Adjustable Arm Cantilever Rack

Single and Double Column

BY JARKE corporation





The all new modern, standard design, low cost storage rack.

ANDARD ...

A most practical solution where storage is a problem.

Ideal for your Maintenance Department, Tool Room, Turret Lathe and Screw Machine Stock.

Brake Die Storage and other Departments.

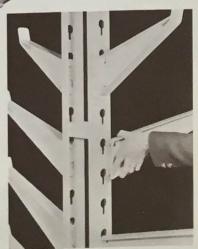
Featuring:

Heavy Duty Design for Lifetime Service Low Cost Free Standing

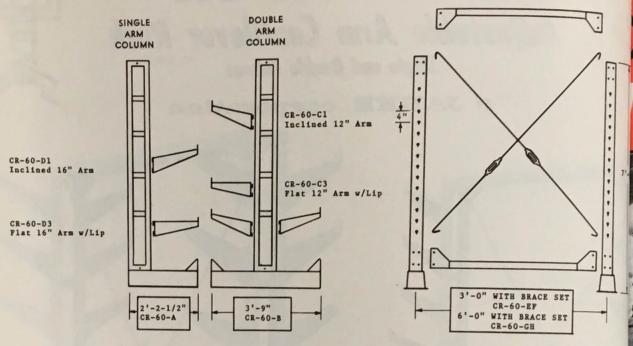
**Erects in Minutes** 

Completely Flexible Arms Require No Nuts or Bolts, Just

"Button" Them On! See Specifications and "How to Order"



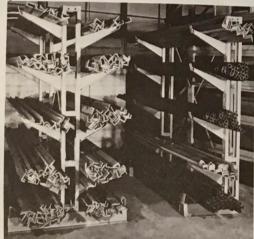
#### DIMENSIONS AND PART NUMBERS



#### ORDER BY PART NUMBER

CR-60-A	CR-60-B	CR-60-C1	CR-60-D1	CR-60-GH	CR-60-EF
Single Arm Column	Double Arm Column	CR-60-C3 Flat 12" Arm w/Lip	CR-60-D3 Flat 16" Arm w/Lip	6 Ft. Brace Set (Complete)	3 Ft. Brace

# SPECIALS ARE STANDARD WITH JARKE!



STORING 8 FT. MISCELLANEOUS STOCK



#### corporation

6333 W. HOWARD STREET CHICAGO, ILLINOIS 60648 (312)-647-9633 Modern Storage Systems Is Our **ONLY** Business.

Write, wire, or phone for a trained Jarke representative to discuss your storage problems...
No obligation, of course.



STORING 12 FT. BRASS AND ST Photo courtesy of Gib

DISTRIBUTED BY:

# Steelmobile MPLIFIES and SPEEDS



JUST ROLL STOCK

TO MACHINES

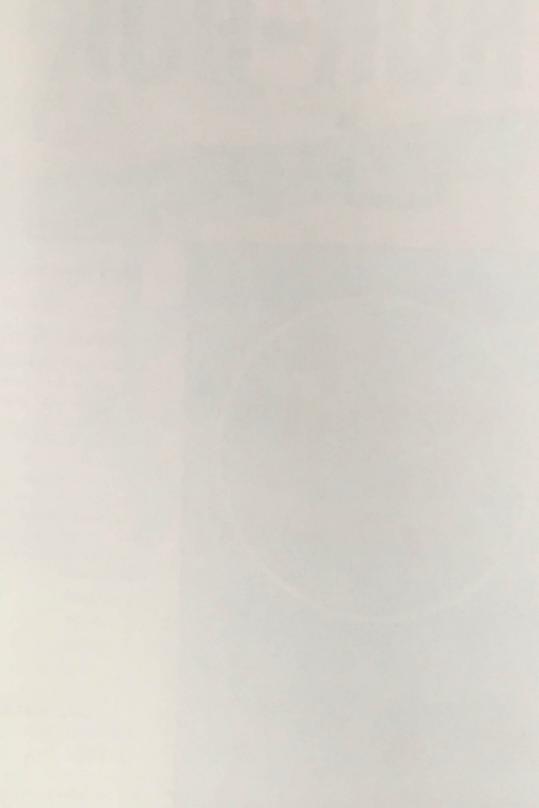
... and start feeding

**No Unloading Necessary** 

### TOP IS ADJUSTABLE

stock can be positioned to suit varying machine heights and angles

INCREASES FEEDING SPEED STEPS UP PRODUCTION



# JARKE POWERMAT

ING and POSITIONING EQUIPMENT



U.S. PAT. NO. 3,568,804



JARKE

corporation

6333 West Howard Street Chicago, Illinois 60648 (312)-647-9633

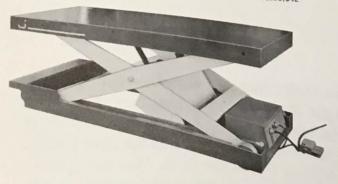
Powermat\* Special Handler for Aircraft Freight Modules...elevates, weighs, transports, conveys, demonstrating the versatility of functional design possible with the Jarke Positive Mechanical Ball-Screw Drive. This unit handles standard air freight "igloos" and performs a wide variety of necessary functions. It elevates, weighs, transports and conveys. Elevates from 18 to 42 inches in 25 seconds, with capacity of 12,000 lbs. Rollers may be powered, if desired.

\*Trade Mark

# JARKE POWERMA and Positioning Equipment





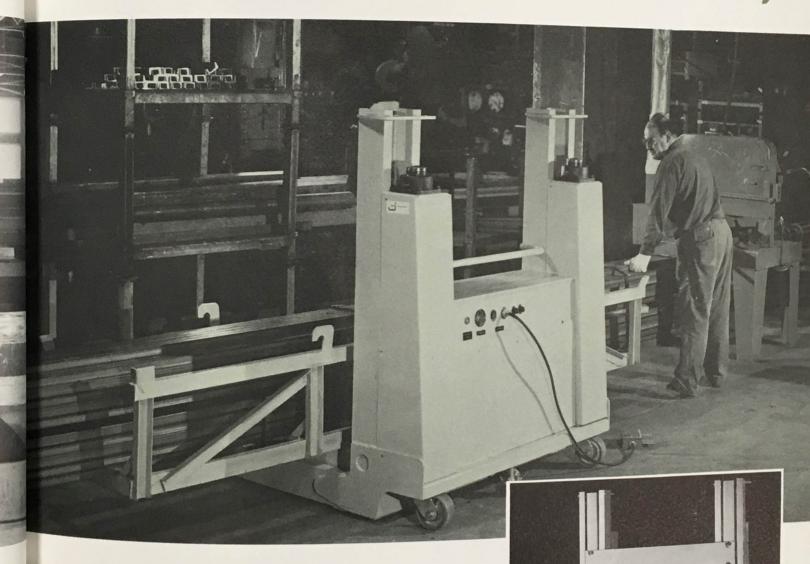


TABLES provide greater reliability and less maintitable than hydraulic tables of equal capacity. Positive me high cal ball-screw drive repeats cycle after cycle with no high positioning control at all times. Capacities from 6 ted version from 20 inches to 44 inches in 35 seconds. For crane and hoist duty brake motors supplied in 2, 3 horsepower.

Details show rugged engineered construction. Solid steel box-formed top, heavy-duty structural base and rigid scissors mechanism. Low-friction bearings installed in all moving parts. Supplied with steel wheels and casters, plus floor lock.

JARKE corporation

# andard and Special Elevating eases production capacity of expensive machinery



TION Flowermat\* SPECIAL OPEN SIDE POSInter justable in height from as low as 7 inches to mecas high as 72 inches with positive mechanno cical ball-screw drive. Elevates fully in 60 poseconds. Fail-safe, with no creep or drift. 6, Fixed wheels plus casters permit precise po-4 in sitioning. Operator has positive foot control.



\*TRADEMARK

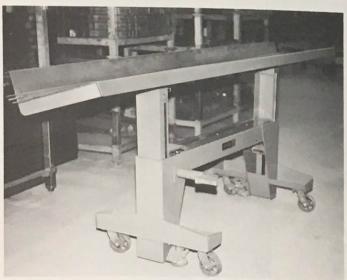
Powermat\* SPECIAL OPEN SIDE POSITIONER handles bar-rack loads of stock, placing individual pieces at correct height for feeding. One application, feeding small-diameter tubing to a cut-off, increased production 22% through that station. Handles long stock lengths with ease.

# JARKE STEELMOBIL

Speeds Handling, Transportation, Feedi



JARKE STEELMOBILE®—Thousands of these units are speeding production in plants from coast to coast. With capacity of 2,000 lbs., adjustable fixed height from 32 to 42 inches, lengths of 6, 8 and 10 feet, these stock units speed handling, transportation and feeding. Adjustable top tilts to 45° angle, has 6 inch back flange to hold stock for punch presses, shears, screw machines, etc.

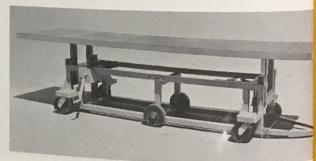


PATENT PENDING

Jarke Special STEELMOBILE® is basically the same design, with modifications to provide 5,000 lb. capacity and infinitely adjustable height with hand-operated single-crank positive mechanical ball-screw drive. Matches different table heights on shears, cut-off machines, punch presses, etc. Heavier capacities available.



Jarke Extra Heavy Duty Special STEELMOBILE 10,000 lb. capacity for use as feed table for punch press work. Individual stock pieces weig 200 lbs., so rollers are provided to permit easy and handling at press. Fixed adjustable height. Ca heavy-duty wheels permit exact positioning.



Here's a further development. Unit has removable and center heavy-duty wheels in addition to heat end casters, to permit transporting loads fair distances within plant. Capacity: 5,000 lbs. Moreover to be provided infinite adjustment with two mechanical ball-screw drive.



corporation

6333 West Howard Street Chicago, Illinois 60648 (312)-647-9633





corporation

6333 West Howard Street Chicago, Illinois 60648 (312)-774-6464



# TIP-TOTE System cuts handling co

# -an amazingly simple all-mechanical system of material handling -operator never leaves seat!



COLLECT IT...





DUMP OR POUR WITH FULL CONTROL...





Complete mechanical system places added burden on electric or hydra systems of your fork lift—no time-a suming attach/detach operations



U.S. PAT NOS. RE 26988 AND RE 27001

The System – The Tip-Tote\* System sists of two basic units: the adjust height mast with its special hook set; various size of bins with their patented safe pivot connectors, which are engaged the hooks when a dumping or pouring of ation is taking place. Mast set and hooks measured to fit the outer mast of your lift, and are quickly welded permanently place at dump height you select. In some plications, bolted connections can be made to the source of the system.

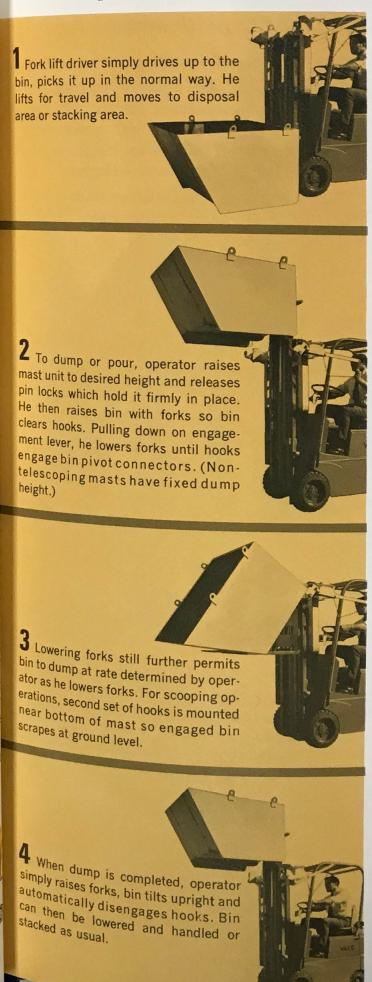
Telescoping lift truck masts present no ficulties, and offer adjustable dump hele without operator leaving his seat.

A second lower hook set is required scooping or scraping operations.

USE LIFT TRUCK FOR ANY OTHER PURPOSE... NOTHING TO ATTACH OR DETACH.

# roducts, production parts, scrap or wastes!

# **How Tip-Tote\* Works**



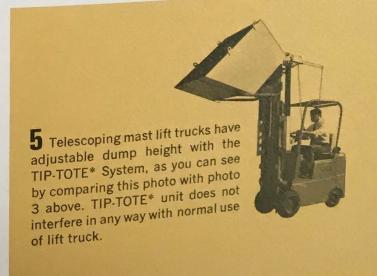
Tip-Tote\* operation is simple and direct. Most operators handle efficiently after one demonstration.

#### **Safety Features:**

Center of gravity remains at all times within basic design plan of the lift truck. With the failsafe TIP-TOTE\* hook set arrangement, any load within the capacity of the fork lift may be safely lifted, transported and dumped. Driver remains seated on fork lift during all operations.

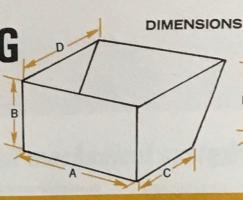
#### Tip-Tote\* is now handling:

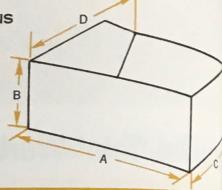
TRASH METAL SCRAP **SNOW** WIRE SCRAP LIQUIDS CEMENT SLAG CONCRETE PRODUCT PARTS SAND PLASTIC PARTS DRILL MUD **FORGINGS FERTILIZER** CASTINGS RUBBER **STAMPINGS GRAIN** FOOD PRODUCTS **FIBERGLASS** 





# STACKING DUMP





#### What size TIP-TOTE\* System for you?

The "size" of the system depends strictly on the capacity, size, mast height and general capabilities of your fork lift. Measurements are taken from the lift truck itself and are recorded on our "Data Specification Sheets" by your Jarke Representative.

The most commonly used TIP-TOTE\* Bins are the 3600, 4800 and 6000 sizes. The 38, 48 and 60 refer to the "A" dimension of the bins, in inches.

Larger bins or special-purpose bins are avail-

In selecting bin size, width of fork carriage the lift truck is important. For the 3600 Se TIP-TOTE\* Bin, carriage width cannot exp 29 inches. For the 4800 Series, maximum is inches, and for the 6000 Series, 53 inches.

Standard bins in each Series are made in a iety of cubic foot capacities by varying "B", and "D" dimensions.

### Box dumping attachment



# Fits Most Standard Lift Trucks Equipped with Tip-Tote Mast Assembly

For those plants already using a system of corrugated steel containers or heavy duty wood boxes, the ALL NEW MECHANICAL JARKE Box Dumper provides a foolproof method of controlled dumping (see Photos).

Design permits simple conversion from fork lift

truck — (1) Remove forks from truck (2) Dr truck (without forks) with fork mounting pl in lowered position up to rear of box dumper raise mounting plate slightly to engage (3) St the two spring loaded retainer latches into

Dumper is now ready for service.

To disconnect, reverse above procedure.



# now

JARKE in your own office the JARKE corporation present 8 minutes un-interru informati on their new TIP TOTE

### system

IN LIVING COLOR AND STEREO SOUND:

See how Jarke's new Tip-Tote system attached to your lift trucks can

See how Tip-Tote increases the versatility of your existing equipment. See how your fork lifts can not only lift and tote skids and large pieces but can handle loose materials and small parts, even liquids. Watch it lift and tote and dump and scrape - completely controlled dumping - and the operator

It's worth every second of those 8 minutes to you and your company. It's worth every second of thindees to you and your company. Write to Jarke or your Jarke representative for an appointment to view



corporation

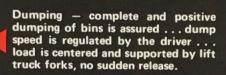
6333 W. HOWARD STREET CHICAGO, ILLINOIS 60648 (312)-647-9633 TELEX 724-401

JARKE WESTERN CORPORATION JARKE WEISTERN OURTURATIUN 603 S. ARROWHEAD AVE., SAN BERNARDING, CALIFORNIA 92408 (714 859 9577)

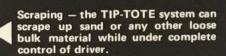
# 1+1=4

TIP-TOTE . . . a Jarke innovation in safe bulk material handling that provides the fork truck owner with four distinct capabilities.

Engineered into every TIP-TOTE system is a patented hardened steel hook assembly making it physically impossible for operator to disconnect hooks from bin during dump cycle.



Heavy steel pivot pins are securely welded and supported to the bin for easy hook-up.



Stacking Dump Bins. TIP-TOTE bins are made in all sizes and capacities. The system is matched to your products and your lift truck.

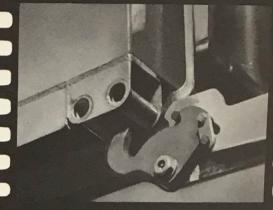
Carrying — TIP-TOTE systems are in service, transporting castings and stampings, chips and burnings, trash and debris, liquids and solids . . . all with complete safety.

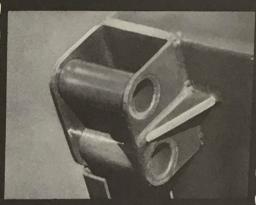
Box Dumping Attachment. As an extra, a box dumping attachment is available for use with heavy duty wood boxes or corrugated steel containers.

Lifting — with TIP-TOTE, the driver can lift material with complete ease while having full control of operation at all times.

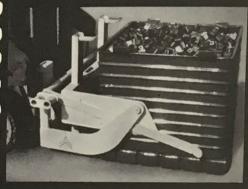
Remember . . . it's all mechanical, maintenance is simple, the driver is safe and in control at all times, the system is designed and sized to fit the customer's need — dumping is smooth, controlled and complete.

ONE PLUS ONE DOES EQUAL FOUR!

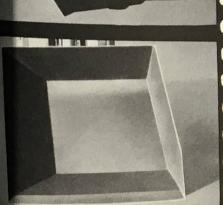






















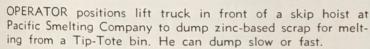


JARKE

COrporation
6333 W. HOWARD STREET
CHICAGO. ILLINOIS 60648
(312)-647-9633 TELEX 724-401

JARKE WESTERN CORPORATION
603 S. ARROWHEAD AVE., SAN BERNARDINO, CALIFORNIA 92408.
(714 889-9577)







LOWERING forks tilts the Tip Tote bin, causing it to dump its load. The operator remains on the truck. Bin is securely locked to the mast with a hook and latching device.

### New Bin System Saves Time, Reduces Hazard for Smelter

Operator remains on the truck and controls dumping with forks

P ACIFIC Smelting Company, the world's largest secondary zinc smelter, was never entirely happy with the bin system in which it collected scrap and other materials in various parts of its plant, which covers 14 acres in Torrance, Calif., a few miles south of Los Angeles.

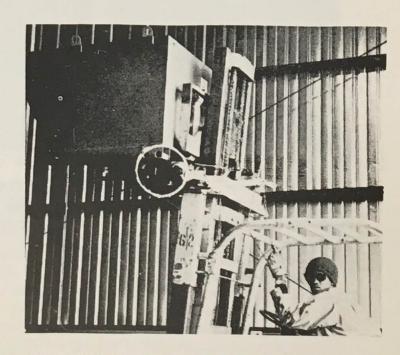
The company makes three principal products —

zinc oxide, zinc dust and metallic zinc. The oxide is used in the manufacture of rubber. Dust is a bleaching agent in paper pulp and is used in making some paints. Metallic

zinc, of course, is used in galvanizing lines. The raw material at Pacific Smelting is zinc bearing scrap. It consists mainly of automotive parts and just about any other zinc die castings. The scrap is collected in bins, which are then picked up on lift trucks and taken to furnaces for melting and distillation. At the furnaces, it's

dumped into hoppers or skip hoists.

The old bins had too many parts that could be dam-The old bins had too many parts that could be damaged, and they required considerable maintenance. They're mounted on a base with two tracks, and there's a release mechanism. When they're dented, they don't work propmechanism. mechanism. The load than profit work properly and have to be repaired. For dumping, the lift truck operator raises the load, then positions the truck so that the load is above the receiving hopper or skip hoist. Positive load is above the precise because over the load is above the precise because over the load. the load is the precise because once the dumping starts, it can't be stopped, and it's possible to dump all or part of a load on the floor.



TO LOCK Tip-Tote bin to the mast, the operator raises the bin above the level of the hook and latch. He pulls a chain to open the hook, then lowers the forks. The pivot connector on the bin engages the hook. The operator releases the chain to close and lock the hook.

#### **New Bin System**

After the truck is in position, the operator must leave his seat and reach up to release a lever on the bin. The bin rolls forward and dumps the load, placing a shock on the tilt cylinders of the lift truck as it does so. Occasionally, a bin will slide right off the forks and fall, endangering the operator and damaging equipment.

So the system was regarded as unsatisfactory on three counts-safety, uncontrolled dumping, and maintenance.

"We always seemed to have a line of bins waiting outside the shop to be repaired," says John C. Schmidt, process

engineer for Pacific Smelting.

Nearly a year ago, the company adopted a new system, the Tip-Tote, made by Jarke Western Corporation of San Bernardino. It consists of two basic components—an adjustable height attachment that mounts on the forklift, plus bins with pivot connectors mounted at their base. For dumping, the bin pivot connectors are engaged by an operator-controlled hook and latch device on the forklift attach-

There is no mechanism on the bins requiring maintenance. The dumping attachment unit is permanently mounted on the lift truck, yet does not interfere with the

use of the truck for all normal purposes.

In dumping, the operator remains in his seat on the truck. First, he raises the load above the level of the hooks on the mast. Then, he pulls a chain, which is within easy reach, to open the hooks. Next, he lowers the forks. The pivot connectors on the bin lock onto the hooks. The operator

then continues to lower the load. With pivots locked onto the fixed hooks, the bin starts to tilt.

The rate at which the operator lowers the forks deter mines the dumping rate. He can dump slow or fast or partial load, then raise the forks and dump the remainder somewhere else.

By remaining on the truck, the driver is well out of danger. The bin cannot be disloged due to built-in fail.

safe feature.

In its initial order, Pacific Smelting acquired one sys tem. That is, it purchased 17 bins and had one lift truck fitted out with an adjustable height mast unit. The system worked so successfully that a few months later it added two more systems—two more mast assemblies and 25 more bins for a total of 42.

The heavy duty bins have a capacity of 1-1/3 cubic vards. They have required almost no maintenance. The truck assemblies receive routine preventive maintenance when the trucks go into the shop for regular servicing.

"I feel the Tip-Tote is a much better system," Schmidt said recently, "I thought it would reduce maintenance costs and it has. You can stop the dumping, or dump as fast or as slow as you wish. The operator has complete control. I feel it's a lot safer. The bins can't fall off.'

An added bonus is greatly diminished wear on the tilt cylinders during dumping. The center of gravity in a loaded bin actually moves back toward the mast during the dump cycle, which allows full use of the forklift's capacity.

Schmidt believes the Tip-Tote system has produced significant savings in three areas: maintenance, handling time, and operator safety.





#### **IDEAS**

# P&L Reports New Stores Ideas Norking Efficiently

R. "Jimmy" Killingsworth, Superintendent of Stores t Florida Power & Light, reports on a number of interiorations put in use during the past 12 to 18 months. Other new methods are presently being designed and the sted by the company, but those shown are presently use and operating efficiently.

A new 25,000 lb. fork lift is being used to load leavy reels of 18-20 thousand pounds of cable on able trailers or trucks (Fig. A). Previous handling of hese reels required the rental of a crane. "The new ft is also being used with company-fabricated cable eel racks at our Miami Central Cable Yard," accordng to Killingsworth. These racks (Fig. B) provide wice the cable storage in the cable yard. They were abricated from salvaged substation structure steel in he company Reclamation and Salvage department. lixteen racks are now in use throughout the system, vith more being fabricated as steel becomes available. Another innovation is a company fabricated reel rack Fig. C) which provides increased use of air space. Jsed with a commercially available coiling machine, hese racks are valuable for coiling and re-reeling of onductors.



Fig. A. New 25,000 lb. folk lift.

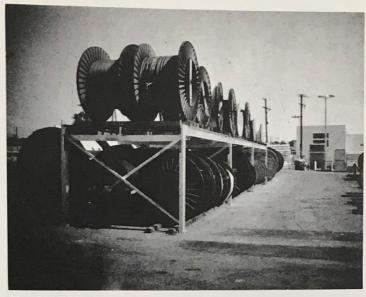


Fig. B. Cable reel racks, end view.

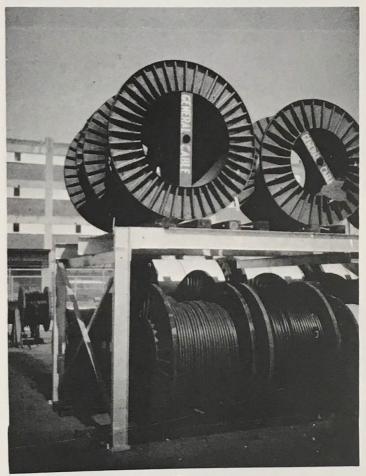


Fig. B. Cable reel racks, side.

Commercially available "stacking pallets" are being used in a variety of applications at FP&L. A complete substation air blast switch assembly (Fig. D) is stored together using three such pallets. In another use, each pallet (Fig. E) contains a complete tower assembly, including the nuts, bolts and washers (stored in the five-gallon cans). The arresters shown (Fig. F) are stored in less than 1/5 the ground space they required just one year ago, prior to the use of the stacking units. Scrap steel chanel is used to prevent the legs of the stacking unit from sinking into the asphalt. Large switches (Fig. G) are also stored, safe from damage, in a fraction of the space previously required.



Fig. C. Company fabricated reel rack

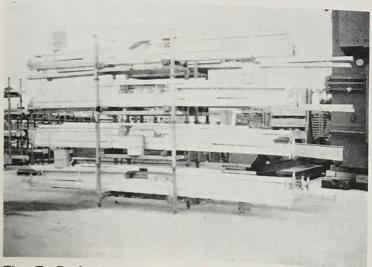


Fig. E. Racks for complete tower assembly.

Transformers are another item successfully stored on the "stacking pallets". Jimmy Killingsworth reports that FP&L now has on order a special adaptation of these racks. Rather than a wooden deck which is standard, the channel webbing, visible on the top unit (Fig. H), has been increased and an expanded metal deck will be used. "This innovation", says Killingsworth, "was suggested by one of our own storekeepers when confronted with the storage of some 3500 to 4000 transformers."

Racks have been used for reel storage at FP&L for over three years and their usage has been expanded to store a great variety of material, including



Fig. D. Stacking pallets hold complete air blast switch assembly.



Fig. F. Arresters are stored in one fifth space previously

C, guy protectors and strain insulators, ground rods, ay panels and many others. Superintendent Killingsth reports that the company has requested a special
sign from the manufacturers, with the standard
ad uprights replaced with the same removable upth and socket arrangement as the "stacking pallets".
This will eliminate" he said, "the wasted space beten reels and the next rack." (as shown in Fig. I).



G. Large switches stored in racks



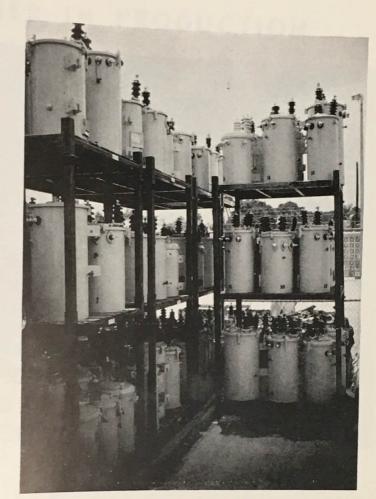


Fig. H. Expanded metal decks specified.

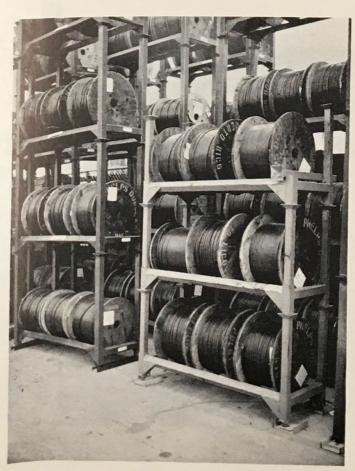


Fig. I. Design change will eliminate space between racks.

I. Stacking pallets for reels.

#### JARKE corporation

6333 HOWARD ST. CHICAGO, ILL. 60648 312 647-9633



# AIRECTOR® .... PARTNER IN PRODUCTION

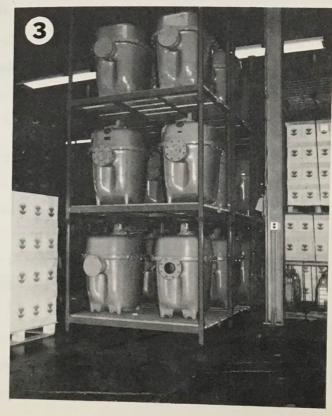




#### RACKS FOR GAS METERS

- 1. Wash rack.
- 2. Storage rack -- residential meters.
- 3. Storage rack -- industrial meters.
- 4. Storage rack -- commercial meters.





Jarke Corporation File 4-AR-134

#### GAS METERS GET A LOWER BILL

Handling problems sometimes occur in unexpected places, as in this experience by Bob Wall, Sales Engineer for Container Systems, Inc., exclusive Jarke representatives for Chicago. Working his territory, Bob spotted construction at a major gas utility. "I was driving by and saw new steel," he relates, "and just stopped in cold to see if we had something to offer."

It turned out to be a new repair facility for gas meters needing exactly what Jarke had to offer: a tailor-made Airector. Bob Wall's instinct for spotting the "stackables", and his careful follow-up analysis, resulted finally in a rack installation combining an efficient production-flow concept with space-saving high-cube storage.

At this specially equipped site, residential, commercial and industrial gas meters arrive from all over the state for periodic calibration and overhaul. In the expansion program, as Bob describes it, all the obvious equipment for handling the meters had been provided for. A conveyor circled the process area, fork trucks and pallet transporters efficiently moved loads through storage and the work zone, but, the entire system still depended on a wooden pallet as the carrier and storage platform. What's more, one-level storage prevailed, with the possibility of crowding developing as activity increased.

Working with Bob, Jarke delivered four Airector designs to handle movement and storage of all meters, with potential cost savings introduced at every point in the operation -- including the process cycle itself.

#### #1 Wash Rack

At the outset, arriving meters load directly load directly into an Airector that serves as the workhorse of the installation -- a wash rack. 60 residential meters are placed on wire mesh shelves in the rack and retained by removable bars. At the wash station, spray nozzles enter clearance spaces between shelves and in fifteen minutes complete a cleaning cycle formerly requiring forty minutes. Saved: individual handling and washing, removal of banded meters from a wooden pallet.

Moving to an inspection area, clean meters unload onto a conveyor. Accepted units and those requiring adjustment only continue through work stations to paint and storage in a second Airector design. Meanwhile, empty wash racks

return for another load, shuttling back and forth in their role as combination storage device and production fixture.

#### #2 - Storage Rack

Similar to the wash rack but lacking shelves, this Airector design retains the removable bar feature and is capable of an 80 meter load. Finished meters go to storage in this rack, while meters needing repair bide their time in the same Airector design -- awaiting recall to the work zone as scheduling permits.

#### #3 - Storage Rack (Commercial)

A third variation of the basic Airector receives the larger commercial meters, an improvement over the practice of storing these bulkier units on the floor with no possibility of stacking.

All three Airectors described have the same  $45 \times 48$  inch base and interstack for maximum efficiency in utilizing available warehouse volume.

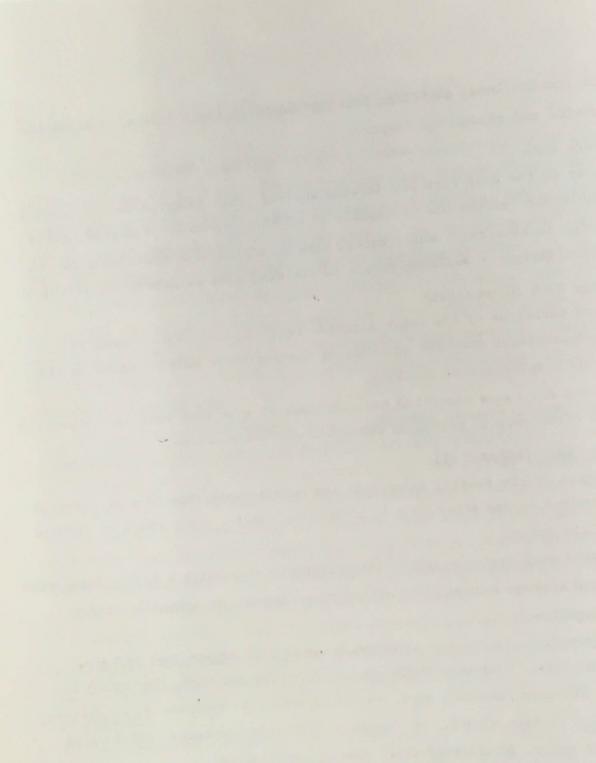
#### #4 - Storage Rack (Industrial)

The giants of the family, industrial gas meters, sometimes have an Airector all to themselves -- one meter on a  $42 \times 60$  base. Again, floor space is reduced by going to the air.

Thus, four rack styles -- three interstackable -- provide a highly integrated production and storage system, with Airectors performing an unusually active processing function.

All Airectors in the system allow 4-way entry with either fork lifts or pallet transporters. With over 2,000 pounds of meters per rack, they stack 4 units high. All have removable posts and knock down flat when not in active use, or when shipped between plants. An important additional feature: all 4 racks or when shipped between plants. An important application.

Better than doubling warehouse capacity, Airectors have reduced individual meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping, cutting, meter handling by two-thirds and eliminated any need for safety strapping cutting, meter handling by two-thirds and eliminated any need for safety strapping.



### RAPID DELIVERY WITH RETRIEVER-RACK DUO







Jarke Corporation File 3-ME-299



#### RACK FOR SEWING-MACHINE PARTS

- 1. Storage section paralleling machine department.
- 2. Retriever in travel aisle.
- 3. Pallet-truck pickup point at floor level.
- 4. Truck and rack at machine station.
- 5. Typical rack load.



### NEVER UNDERFOOT ... ALWAYS THERE WHEN YOU NEED IT

Combining random access with rapid material flow, a unique partnership between a stacker-retriever and special-design Jarke rack eliminates the need for any in-process storage at machine centers.

At Union Special Machine Company's new Huntley, Illinois plant, expansion of the machinery department established an innovation in the production of industrial sewing machines. A complex job-lot sequence of operations moves through any of 171 machine tools, processing as many as 30,000 items under 70 orders at a given time. With such random machine-to-machine progression, a giant traffic jam might have developed.

Nothing of the sort happens; material is delivered to a machine in the Jarke rack only as needed and removed to storage as soon as completed. Quick delivery and takeaway eliminates the traffic problem. There is no clutter, no bunching up at slower stations.

Sewing-machine components fill adjustable shelves in the special rack to provide a dense unit load. Measuring  $48 \times 40$  inches at the base, it's designed for pickup by a pallet truck or shuttle of the automated high-storage (42 feet) retriever.

Paralleling the machining area, the storage system keeps its retriever busy moving racks to coded bays and delivering them at floor level within 30 feet of a designated machine. Machine operators set a delivery cycle in motion as they require material, picking up a nearby phone and calling central control. Referring to his card-control system, the dispatcher sends the retriever to a storage location, from there to a delivery point -- practically next to the phone and within minutes of the call.

Machine operators do the rest, using pallet trucks to move racks to their machines. The return cycle is simply a reverse: loads are returned to the

delivery point, central dispatch is called and the retriever appears to take away the Jarke rack with its processed parts.

Another design variation of the same rack is used to handle tools and fixtures, offering the convenience of an automated tool crib as part of the same storage movement.

An example of the unique way in which storage and production are merged through careful planning and special design, the retriever-rack system enabled Union Special Machine to construct a building 28,000 feet smaller than a structure designed around older methods. At \$16 per square foot, this saving alone was more than the cost of the entire new handling system, including retriever with storage, Jarke racks and pallet trucks.

With the other benefits accruing from the innovation -- elimination of waiting machine time, improved inventory control, replacement of the numerous 4-wheeled trucks previously used -- the total cost of the system, according to Finn Braathen, Material Handling Engineer at Union, will payback in three years.

### DAMAGE PROTECTION...HIGH STORAGE



File 1-ME-261

#### PAPER CONVERTERS SPACE SAVER ALSO A WASTE SAVER

4,000 pounds of coated paper wrapped to a giant diameter of five feet creates some unusual problems for converters (producers of paper specialties).

Not only do rolls of this size consume space, their easily damaged nature produces waste and reduces the output of final product.

Both problems are efficiently resolved with a Jarke custom stacking rack.

A rigid tubular structure surrounds the rolls and keeps it suspended -- the core resting in cradles incorporated in the framework.

A roll never touches the ground, as it did before the rack system was installed. This feature alone can save a hundred feet of awkward waste when several layers of damaged wrap have to be discarded at the start of the conversion process.

Handling by fork lift or pallet truck is a feature of this design along with internal clearances that allow easy roll deposit with crane slings or twin hooks. In addition, open cradle supports provide alternate ram or C-Hook roll deposit.

Three-high stacking, made easy with the "Large-Target" nesting arrangement built into the four posts, immediately reduces floor space by two-thirds.

For paper, film, and foil converters, an excellent example of two Jarke storage principles -- maximizing use of building volume and protecting the product -- is illustrated in a "Space Saver" that is also a "Waste Saver."

\* \* \*

Jarke Corporation

## PRODUCTION EFFICIENCY WITH MOVING STORAGE





#### RACK FOR BATTERY CELLS

- 1. Obsoleted skids, replaced with stacking racks -- a special Jarke design.
- 2. Rack details -- empty and loaded.
- 3. Product completely protected.
- 4. Rack at work station.





Jarke Corporation Stacking Rack File 2-ME-359 Special

#### BATTERY RACK SAVES CELLS

Costly product rework spurred a search by a Westinghouse Division -- K-W Battery Company of Skokie, Illinois -- for a better way to handle and store industrial battery cells. A method was needed that would reduce damage to the laminated plate assemblies -- a particularly vulnerable stage of battery building before the final encapsulation.

A special Jarke design not only eliminated plate damage, but replaced an aging assortment of wood-faced skids with stacking racks incorporating a number of other improvements.

An immediate bonus: multiple stacking of the new battery rack tripled storage volume without requiring any addition to existing floor space or a change in the layout. This gain alone justifies most rack installations, as well as providing the means for paying back the cost.

Guard rails, some removable, surround the rack and allow compact loading to the very edges of the deck without any danger of cells tipping out -- accidental damage eliminated; more space gained. Intermediate divider bars, dropped into place in a variety of positions, further stabilize the cells against internal jostling -- a source of damage in the old method.

Another functional refinement provided in the tailored design features a wire-mesh deck, allowing free drainage of chemical solutions as well as enhancing circulation of air through the processed cells. Dipping the entire rack in a plastic coating protects it from corrosive attack and minimizes abrasive wear against plates. Selective coatings make it possible to anticipate specific chemicals used in the process cycle.

As Jarke special designs often do, the K-W battery rack moves through the production line -- unloading material, receiving product -- eliminating extra movement, idle storage and re-handling. The possibility of combining production flow with storage in this application, generates cost savings that repay the investment -- another feature built-in by Jarke.

\* \* \*

Jarke Corporation

### ork truck / racks cut floor area 90%

What does management with a orage and handling problem in other elds do to achieve a quick and money wing solution? They often turn to be metalworking industry, we arned in an interview with Gust faris, a regional departmental manger for one of the world's largest percantile establishments.

The problem that influenced their ction was warehousing and handling soft goods (floor coverings) in units excess of 300 pounds in form of olls which, as Maris pointed out, are imilar in shape and bulk to coil, rod or tube processed in many metal-working plants. (Fig. A).

The warehousing department has had a lot of experience over the years handling hard goods also, so it was logical they took a good look at storage and handling processes in metalworking plants and warehouses. They felt that with a modification in type of material-stack racks they could improve their process, make better use of their fork trucks, and meet all requirements of storing and handling of floor coverings at greater savings in cost of time, labor and space.

According to Mr. Maris, the savings story began with a routine fire safety inspection. Up to that time, they stored approximately 1,000 rolls of rubber and felt cushioning (the padding used under carpeting) in 12 foothigh cordwood stacking arrangements. Each of the rolls weighs 300 pounds. Mr. Maris explains the former cordwood stacking problem and why it was replaced. (Fig. B.)

Why it was replaced. (Fig. 1977)

Because the padding was potentially combustible, and the cordwood stacking pattern left no air space bestacking pattern left no air space between the rolls, their safety inspectors

ruled that the rolls could be stacked no higher than five feet.

"Since each five foot back took up a 9 x 9 foot area, this meant we would have to more than double our storage area if we continued to use our present racks and the cordwood stacking system", Mr. Maris explained.

Because space was — and still is — at a premium in the warehouse, and because moving the padding racks to another section would increase material handling costs, management searched for another solution.

They found the answer in the Jarke Airector stacking racks, a highly flexible stacking rack system designed exclusively for fork-lift handling as used in this warehouse, and it is able to hold heavier loads, more safely, with more flexibility than any other rack formerly used.

By the switch from the cordwood style of storage rack to the new stackable and more flexible Airector rack, the department is saving \$20,000 annually in material handling and labor costs in the Franklin Park (Illinois) warehouse. The 800,000 square foot warehouse, adjacent to Chicago's busy O'Hare Airport, serves 500 company retail stores in a ten state area. The floor covering section covers 105,000 square feet of space and contains complete facilities for receiving, storage, cutting and reshipping of carpeting and related items to stores in Region No. 2.

In addition, they have picked up an extra 6,400 square feet of costly storage space and eliminated the potentially dangerous safety hazard by converting to the new racks.

By installing the Airector racks, it

was possible to stack the padding rolls four-stacks high with sufficient air space between layers to successfully eliminate any fire hazard.

The new racks safely hold up to 4,000 pounds as opposed to the 1500 pounds capacity limit of the previous racks, so that the company has been able to double its storage capacity in the same space. (Fig. C)

As soon as a rack is emptied of its padding rolls at the Franklin Park warehouse, it is removed and set aside to allow access to the next full rack.

"With the old racks it was a big job to break them down and get them out of the way", said Mr. Maris. "It used to take a 40 x 45 foot area just to break down 25 racks. With the new stacking racks, we can break them down 20 times faster and in only a 5 x 5 foot area."

"And, because the new racks can be custom designed to fit any available space, they can be used in virtually every area within the warehouse to hold different size and weight items."

At present there are 104 of the new style stacking racks in use in the floor covering warehouse, but Mr. Maris had recommended the purchase of additional units for use with imported Japanese braid rugs.

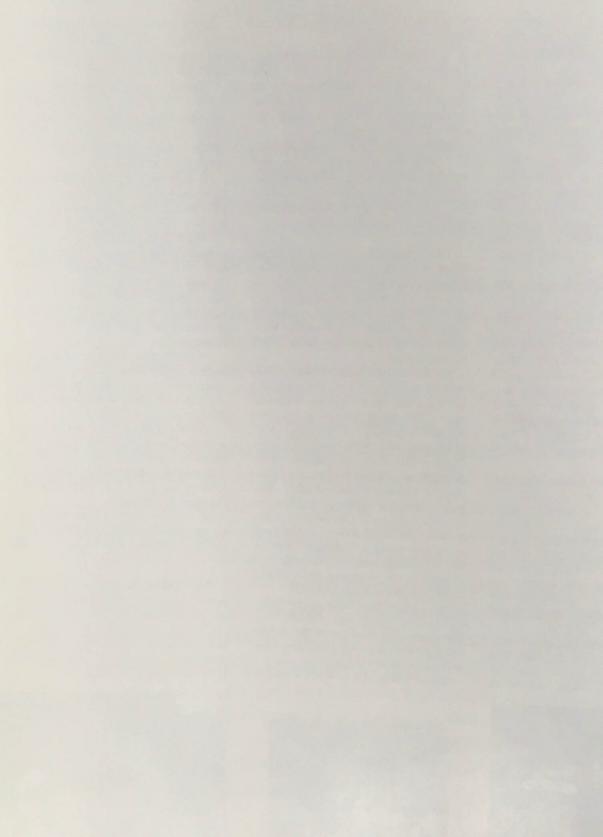
He foresees saving in the braid rug section of \$40,000 annually by converting to the new style racks.

The rack manufacturer, Jarke Corporation, is based at 6333 West Howard St., Chicago, Ill. 60648. The installation, of which Mr. Maris is manager, is one of the vast complex of warehouse facilities of Montgomery Ward & Company, Chicago.





Reprint from Production Equipment, September, 1971



#### PUBLIC LAW 91-596

### WILLIAMS-STEIGER OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

(OSHA)

As you know, the passage of the ACT has had considerable impact on the industrial scene -- certainly "OSHA" is frequently heard and frequently encountered. It's presence, moreover, cannot be regarded as a temporary political exercise soon to lapse.

We find, in our dealings with customers and representatives, that a certain amount of misunderstanding and misinformation has developed concerning the enforcement of the ACT's provisions.

We'd like to give you a brief summary of this new legal presence, as we see it, and convince you that those provisions of the ACT that apply to our market are quite brief and offer very positive selling opportunities.

#### THE ACT AND THE ACTION THAT FOLLOWED

To review: the original ACT's purpose, as established in 1970, aimed at providing workmen with a safer place to work. This intent came to a sharp focus when Sections 5(a) and 8(g)--providing that within two years existing national consensus standards and established Federal standards be promulgated by rule-were written in as an amendment.

That amendment, Part 1910, became Federal law in April, 1971, and it borrowed heavily from:

American National Standards Institute (ANSI) National Fire Protection Association (NFPA)

Since these are well known ("national consensus") and respected organizations, Since these are nothing new or surprising to existing concepts of safe their standards added nothing new or surprising to existing concepts of safe their standards added nothing to the same of the amendment, of course, was to make a violation of practice. The new effect of the amendment, of course, was to make a violation of a standard a Federal violation--subject to fine.

### FEDERAL INSPECTORS AND "OSHA"

Federal inspectors began writing citations enforcing these well established Federal inspectors inherent in good housekeeping, safe practice, and standards and principles OSHA became a hard fact. protection from hazard. OSHA became a hard fact.

A point worth noting concerning an inspector's responsibilities is contained in Section 9(a) of the ACT:

"Each citation shall be in writing and shall describe with particularity "Each citation shall be violation, including a reference to the provisions of the nature of the violation or order alleged to be the nature of the viole, regulation or order alleged to have been violated."
the ACT, standard,

#### WHAT HAS OSHA TO SAY ABOUT MATERIAL HANDLING?

Of the 248 pages in the Federal Register which describe the Amendment, Part 1910, a little over one page, has bearing on the Jarke market. We refer

Sub Section 1910.176 Handling materials-general (1/6 page) Sub Section 1910.177 Indoor general storage (1 page )

The first, Sub Section 1910.176, has two pertinent paragraphs:

#### (b) Secure Storage

Storage of materials shall not create a hazard. Bags, containers, bundles, etc. stored in tiers shall be stacked, blocked, interlocked and limited in height so that they are stable and secure against sliding or collapse.

#### Housekeeping (c)

Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire explosion, or pest harborage. Vegetation control will be exercised when necessary.

Jarke products are tailormade to accomplish the organization of storage into a safe environment as outlined in these pertinent paragraphs. Our business has been built on providing safety and efficiency with:

AIRECTOR

STRIP COIL RACKS AND COIL RACKS

MINI-MODULE

BAR RACKS

STEELTREE

HI-DRUM

The other Sub Section, 1910.177, is concerned with provisions for fire The other Sub Section, of a safely organized environment. One subparagraph is worth quoting:

### Piling procedures and precautions

1. All commodities shall be stored, handled and piled with due regard to their fire characteristics.

Again, a modular storage system built with Jarke products will organize Again, a modular storage areas to satisfy the requirements of density control, warehousing and storage provision--all OSHA stipulations warehousing and storage distribution and storage distribution of the requirements of sprinkler exposure, aisle provision all OSHA stipulations.

### WHAT OSHA DOES NOT SAY

Nowhere in the ACT is there a description of any kind of rack, pallet, Nowhere in the ACI is equipment except the general reference "storage aids". bin or any other storage to categorize them as combustibles or not feel is made to categorize them as combustibles or not feel is made. bin or any other storage of categorize them as combustibles or not for fire This designation is made to categorize them as combustibles or not for fire

protection classifications. Whatever you've heard concerning how racks or storage equipment are to be built is a misunderstanding. The language we've quoted is as specific as the ACT gets in this regard.

#### SPECIAL NOTES ON THE HI-DRUM

There is a special application note with respect to the Hi-Drum which needs mention. Sub Part H - Hazardous Materials, leans heavily on NFPA for regulations and in Sub Section 1910.106 Flammable and combustible liquids, there is a sub paragraph clearly preventing the application of Hi-Drums, except for one unit directly on the floor:

#### (v) Storage in Inside Room

In every storage room there shall be maintained one clear aisle at least 3 feet wide. Containers over 30 gallons capacity shall not be stacked one upon the other ...

Inside storage rooms are those built to meet fire restrictive codes and feature construction details such as a lowered floor, self-closing door, sprinklers, etc.

Further in the same Sub Section 1910.106, however, pertaining to 'Flammable and Combustible Liquid warehouses or storage buildings" there is a distinct opportunity for a Hi-Drum contribution:

Containers in piles shall be separated by pallets or dunnage where necessary to provide stability and prevent excessive stress on container walls.

Certainly the confirming supports of the Hi-Drum provide all of this.

Again in Sub Section 1019.106, a paragraph (9) Housekeeping cites:

(iii)Piling Containers

Containers of flammable or combustible liquids when piled one upon the other shall be separated by dunnage sufficient to provide stability and to prevent excessive stress on container walls. The height of the pile shall be consistent with the stability and strength of containers.

Except for the one special instance, the use of Hi-Drums for proper Except for the one of the step in the direction of safe and secure storage, storage of drums is clearly a step in the direction of safe and secure storage, storage of drums is the Hi-Drum was invented in the first place.

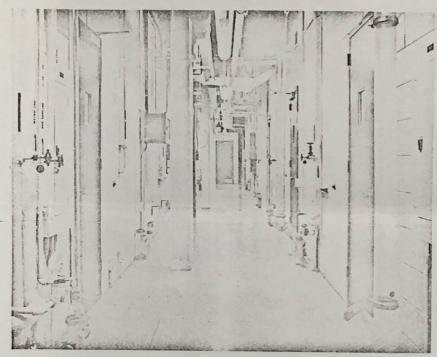
#### OSHA AND JARKE

To put it simply, any planning effort involving a Jarke product or system To put it simply, any promoted safety: now OSHA's intention of improving the environment by elimination is in step with OSHA's We've always promoted safety: now OSHA is in step with OSHA's line environment by elimination of haphazard storage. We've always promoted safety; now OSHA stipulates it.





Me: floors in from to be redere Adheron Coatings corporation Pioneer name in epoxy coatings 3348 WASHINGTON STREET . FRANKLIN PARK, ILLINOIS 60131 May 19, 1972 THE U.S. TREASURY DEPARTMENT Pennsylvania Ave. at 15th St., N.W. Washington, D.C. Attention: Construction Engineer Dear Sir: We will appreciate your consideration of our Adheron Epoxy Emulsion Coatings for your new U.S. Mint at Denver, Colo., and then your directing our literature to interested individuals in your Engineering Department. Adheron Emulsion is a two-component epoxy from a water system that is without pungent solvent odors or fire hazard during application. It creates a durable, chemical resistant coating over all substrates and does not wrinkle or curl previously painted surfaces. Please do not hesitate to request additional information that you may require on this or other Adheron Coatings. We wish to be of service. Very truly yours, ADHERON COATINGS CORPORATION J.F. Beegle President JFB/cg Encl.



This service corridor to a double bank of laboratories at a large midwestern research complex is representative of one of the many areas coated with ADHERON EMULSION.

The ADHERON EPOXY EMULSIONS are widely used as a tile-like coating over filled concrete block but, also, are proving to be an excellent floor coating because of their adhesion and abrasion resistance as verified by this corridor.

Adheron Emulsion works for you because it is waterbase.

#### The story of water base Epoxy Coatings

**ARCHITECTS** prefer Adheron Epoxy Emulsion because the "trades" are not annoyed by pungent odors.

**PLANT ENGINEERS** prefer Adheron Epoxy Emulsion because of its excellent chemical resistance.

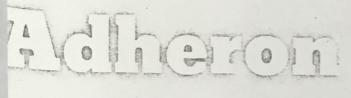
**PAINTING CONTRACTORS** prefer Adheron Epoxy Emulsion because it is pleasant and easy to apply, even over previously painted surfaces.

**BUILDING MANAGERS** prefer Adheron Epoxy Emulsion because it can be used within occupied areas without personnel complaints.

**SAFETY ENGINEERS** prefer Adheron Epoxy Emulsion because of safety during application and conformity to all air pollution regulations.

### ADHERON EPOXY EMULSION MAKES THE TEAM HAPPY

for further information write



IONEER NAME IN EPOXY COATINGS

#### **EPOXY EMULSION COATINGS**

**Epoxy Coatings from a Water System** 

#### Adheron Epoxy Emulsions:

- \* Eliminate all solvent odors
- \* Reduce fire hazard during application
- ★ Conform to all current air pollution controls
- \* Eliminate lifting or wrinkling of prior coatings
- ★ Eliminate bleed-through of color from previous coating
- ★ Eliminate solvent clean-up by using warm water or cold soapy water

# Adheron Coatings CORPORATION

3348 Washington Street Franklin Park, Illinois 60131 (312) 261-1770 The emulsification of epoxies (a water system without toxic solvents) is the most exciting advancement in coating technology since Epoxies were introduced by us to general usage in the 1950's.

Adheron Epoxy Emulsions are the result of our pioneering in epoxy coatings plus fourteen years of experimentation. These new coatings may be applied to most every substrate to create a hard, tough chemical resistant barrier. They exhibit excellent adhesion to masonry, steel, wood, tile, glass, copper, aluminum, zinc and previously painted surfaces.

Adheron Epoxy Emulsion Coatings are two component systems. The pigmented epoxy emulsion component looks more like a slurry than a paint, and it is not a coating until the polyamide curing agent has been added. The addition of the curing agent produces an overpowering cationic emulsification effect creating a true water emulsion of the resins and pigments. The blended materials dry first by coalescing, then by interacting to form an epoxy-polyamide copolymer. Flow properties are similar to a heavy latex paint, yet the cured film has a Gardner 60° gloss of 70%. Applied films of 15 mils do not sag and cure without danger of entrapping water. The thixotropic nature of these materials permit films to tenaciously adhere to the surface without unduly penetrating porous surfaces such as drywall.

To date the performance characteristics of this new concept of applying epoxy coatings have not been fully evaluated and determined. Weatherability and durability is expected to compare favorably with solvent type Adheron. Weatherometer evaluation confirms the tendency to form a slight non-progressive chalking. The same outstanding exterior durability of the solvent-type appears to be characteristic of the Adheron Emulsions.

Hardness is much higher than previously produced solvent type epoxy-polyamide coatings. This indicates impact resistance is limited, but the degree of extensibility is good. Typical values are 20-inch pounds reverse impact for a 1 mil film on 22 gauge steel; and a 1/8 inch mandrel bend.

Mar and abrasion resistance is very high and compares favorably with other highly mar resistant coatings such as the moisture cured urethanes.

Water resistance is much higher than might be expected from an emulsion system. A 1<sup>1</sup>/<sub>2</sub> mil dry film on steel will withstand immersion in boiling water for three days without blistering.

Temperature Service from —30°F to 250°F on rigid construction substrate. Adhesion may fail if temperature changes are rapid and extreme on metals such as aluminum, copper or zinc having high coefficients of expansion.

Toxicity: Adheron Epoxy Emulsion is non-toxic when dry. Health and fire hazards are greatly reduced during application because it is a water system containing less than 10% petroleum volatiles.

Application: By brush, roller or spray. Use a long nap roller for block and concrete. Use a sponge roller for a fine pebble finish on plasterboard and drywall. Refer to direction label for spray equipment recommendations.

Mixing: Top-coats and Metal Primers are blended in the ratio of three parts epoxy emulsion to one part curing agent. Blockfiller is blended at the rate of one pint of curing agent per gallon of blockfiller. Pot-life is from four to six hours depending on temperature.

Colors: Colors, other than our forty decorative colors, may be created with universal colorants. Cal-Ink Color-trend colors and Colwell Colorcard Systems are very accurate. Standardize with dry blended material; color changes with addition of curing agent and intensifies as film dries.

Guring Time: The Adheron Epoxy Emulsion will dry-to-touch in less than four hours depending upon humidity, temperature and ventilation. The film will be print-free in six hours but may have a residue tack for twenty-four hours. Temperatures above 75°F increase the rate of cure and reduce pot-life. Although the epoxy emulsion cures slowly at temperatures as low as 35°F, this is not advised.

Coverage of various systems:	Application sq.ft./gal.	Mil Thickness	Coverage at 1 mil	Cost/sq.ft. Application
Latex blockfiller	80	10	800	.055
Epoxy Emulsion Blockfiller	80	7.5	, 600	.097
Two Topcoats of Emulsion	300	5	730	.073

#### Technical Data

#### Fire Rating:

Adheron Epoxy Emulsion Topcoat 4-6 mils dry

Flame Spread — 5
Fuel Contributed — 0
Smoke Density — 0

Abrasion, Taber CS 17, 1000 grams-101

Washability (TTC-535a) 500 cycles

Fadometer Test-48 hours with no fading

Weatherometer—500 hours, slight loss of gloss and yellowing of white film

Sward Hardness-(3 mil film) 46

Impact Test (1 mil film)—20 inch/lb.

Adhesion (knife test) Satisfactory

Flash Point (T.O.C.)—175°, material solidified

Water Resistance—3 days, boiling water, no blistering

Tensile Strength (lbs./sq.in., 10 mil film) 2457

Elongation (3 mil over 3/8 mandrel)—10.7

Gloss (Gardner 60°) 70%

#### Architect's Specifications:

Masonry: (dry areas) One coat of Adheron Latex Blockfiller shall be applied at the rate of eighty sq.ft./gallon with care being taken to fill all cavities. Two finish coats of Adheron Epoxy Emulsion in the designated color shall be applied at the rate of 300 sq.ft./gallon. Each coat shall dry overnight before the next coat is applied.

Masonry: (wet areas) One coat of Adheron Epoxy Emulsion Blockfiller shall be applied at the rate of eighty sq.ft./gallon with care taken to fill all cavities. Two finish coats of Adheron Epoxy Emulsion in the designated color shall be applied at the rate of 300 sq.ft./gallon. Each coat shall dry overnight before the next coat is applied.

Metal: Steel shall receive approved shop primer or Adheron Epoxy Emulsion Primer at the rate of 400 ft./gallon, followed by two finish coats of Adheron Epoxy Emulsion applied at the rate of 350 sq.ft./gallon. Aluminum and copper shall receive two finish coats of Adheron Epoxy Emulsion applied at the rate of 350 sq.ft./gallon.

Other Surfaces: Wood, tile, glass and previously painted, filled and sealed surfaces shall receive two finish coats of Adheron Epoxy Emulsion applied at the rate of 400 sq.ft./gallon.

PRICES 5'S 1'S

TINT BASE WHITE 11.70 11.95

46 PASTEL COLORS 12.27 12.52

RED PRIMER 12.42 12.67

Trade & quantity discounts

# Uttrawall\* Partition Systems

UNITED STATES GYPSUM

Combine permanent wall performance with flawless beauty for rapid space changes

## Ultrawall:

extra-sturdy for top-quality "feel"

Exceptionally solid and inherently stronger, the panels of ULTRAWALL Movable Partitions are a full 3/4-in. thick, not just 1/2 or 5/8-in. like so many partition panels. Result: satisfying "thump" massive "feel" and unyielding rigidity in completed partitions. All this, plus the ability to capably, handle both immediate space needs and changing requirements—beautifully and economically.

ULTRAWALL Partitions offer a wide choice of features in bank rail, cornice or ceiling height installations. These non-load bearing assemblies provide broad flexibility in economy and performance.

Versatile ULTRAWALL presents a smooth, finished look without exposed studs, batters or fasteners... gives new freedom to plan, control and enhance interiors...provides earlier completion and occupancy in new construction... quick, economical relocation of walls and utilities in existing buildings.

Before you decide on your next partition, look at the many reasons in favor of ULTRAWALL Partition Systems!

ULTRAWALL Partition construction covered by U.S. Patent No. 3,027,605, other patents pending

Copyright 1974. United States Gypsum Company

## **Appearance**

Structural attachments are concealed, no battens are used, and panels are flush to present the clean, smooth appearance of a permanent partition. Decorative prefinished vinyl surfaces in 27 standard colors in five elegant pattern groupings add distinction and beauty—give complete freedom to control the tone and atmosphere of building interiors. A feeling of spaciousness is achieved with easily-installed glazing elements.



## fast Installation

The secret of speedy assembly lies in the simplicity of the specially engineered ULTRAWALL gypsum panels and components. Prefinished panels and trim mean the partition is completed as it is installed—no backtracking is necessary—the job can be completed days sooner. ULTRAWALL is one of the fastest-installing partitions available—movable or fixed! The result is earlier occupancy, lower in-place costs.



# Comfort & Privacy

All ULTRAWALL Systems have sound ratings of 40 STC or above. The Standard ULTRAWALL Assembly, with THERMAFIBER\* Sound Attenuation Blankets in the wall cavity, offers a 47-48 STC rating—40-42 STC without blankets depending upon the type of stud. A special 50 STC wall is available where codes require or where needed for maximum privacy.

\*Reg US Pai Off.



## Safety

All components are noncombustible. Ceilingheight assemblies carry a 1-hour fire rating. No special panels or extra materials needed. ULTRAWALL Partitions assure protection whether or not required by codes. Two-hour rating available with slight modification.



## Economy

Simplicity and speed of the system's installation can give in-place costs comparable to, and sometimes less than a decorated fixed partition. Relocation costs are a fraction of the expense of changing a fixed partition. There's no waste, no debris to clean up.



## freedom to Change

The same ULTRAWALL simplicity and speed provided initially make relocation of partitions quick and economical—providing easier movability. Partition components are salvageable and reusable. Panels store flat—there are no tabs or hooks to interfere with rapid handling.



## Accessibility

ULTRAWALL provides accessibility where needed to suit specific building requirements — independently removable panels without loss of security and as economically as desired. Plus your choice of erecting one side, then completing the other side when ready.



#### Unistrut Western Inc.

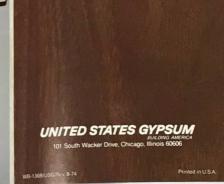
601 South Jason Street Denver, Colorado 80223 Phone: (303) 733-5535

### ULTRAWALL

**Partition Systems** 

#### UNITED STATES GYPSUM

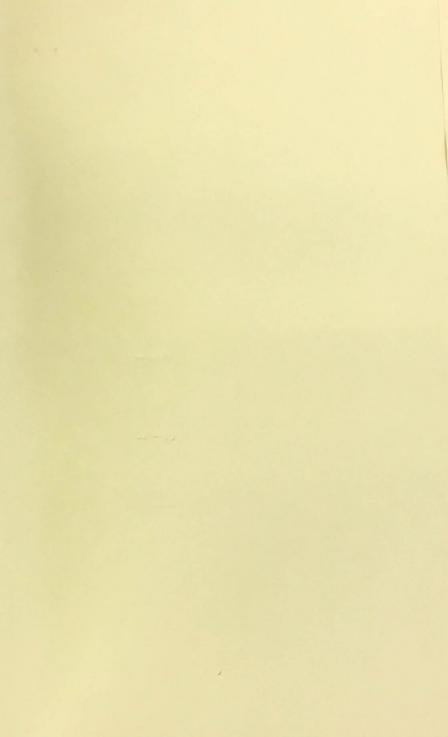
Combine permanent wall performance with flawless beauty for rapid space changes



\*Ang US Pat Off



Construction Material



Denver ment Design Critaria File



## UNITED STATES OF AMERICA GENERAL SERVICES ADMINISTRATION

DATE: June 14, 1974

Region 8

Denver Federal Center

REFLY TO

Construction Management Division - 8PC

Denver, Colorado 80225

SUBJECT:

Project No. N-CO-72-600 New Denver Mint

Frank Rhea

DMJM - Phillips · Reister, A-E

PCJ - Joe Shields

PCJL - Alex Papademetrius

8A - Mike Norton

8P - Jack Packard

8L - John Mathews

8PG - Andy Anderson

8PR - Ben Reed

8PB - George Moore

8PC - Jerry Hillenburg

The project number for the new Denver Mint project has been changed from 72-124 to N-CO-72-600.

It is requested all correspondence concerning the new Mint be identified as follows:

Project No. N-CO-72-600 New Denver Mint

Subsequent to the award of the numerous contracts anticipated under this project, the appropriate contract number, when known, should be used in lieu of the above noted project number.

DAVID L. GESS

Project Director

New Denver Mint

Bid 6/17/4

OPTIONAL FORM NO. 10
MAY 1002 EDITION
CSA TEMPR (41 CFR) 101-11.6
UNITED STATES GOVERNMENT

## Memorandum

TO : Frank H. MacDonald

DATE: September 20, 1972

FROM

Alan J. Goldman

Frank H. Rhea

SUBJECT: Capacity of the New Denver Mint

The following table outlines the planned capacities of the new Denver Mint based on 5 days per week, 240 days per year, 2 shifts per day except in the Melting and Casting Area which is to be operated 3 shifts per day. Volumes are expressed in terms of number of pieces assuming that pennies will account for approximately 85-90% of the output. Pennies account for approximately 75% of the Bureau of the Mint's total domestic coin production. Since the cladding facility is located in Philadelphia, the latter will specialize in clad coins and Denver will specialize in pennies.

	Initially equipped for:		ure building mod. or ansion required for:
Melting and Casting	10.5 billion	15.7 billion	21 billion *
Strip Production	10.5	11.0	21 **
Blanking through Coining	7.7	11.0	21 ***

- \* Expansion for additional melt make-up and storage Estimated cost: less than \$1 million.
- \*\* Increased cold rolling facilities. Hot rolling equipment will be adequate at the outset to support this level of production. Estimated cost: \$1-1.5 million.

\*\*\* Estimated cost: \$3-4 million.

Note that, without any building expansion, coining capacity may be increased to approximately 15 billion pieces per year by producing 3 shifts, 5 days per week. Strip production can be supplemented by purchased strip as an alternative to building expansion.

AJG:sol



## NEW DENVER MINT PROPOSED CRITERIA

### I. <u>MISSION (1980)</u>

- A. Produce 7.7 billion domestic coins per year ranging in denomination from 1¢ through \$1. The estimated total 1980 requirement is 12.6 billion coins per year.
- B. Produce, package and distribute 35 million proof coins and medals per year.

### II. CONCEPT

The mint will perform essentially all functions involved in the production of coins and medals, starting with the receipt of virgin metal and scrap returns, and proceeding through the flow process steps to the production, storage and shipment of finished coins and medals.

Necessary administrative and production support space and facilities are to be included in the mint, including the accommodation of public visitors.

### NEW DENVER MINT PROPOSED CRITERIA

### III. PRODUCTION PARAMETERS - ANNUAL BASIS (1980)

### A. Domestic Coin Production (Pieces)

1¢	-	6,780,000,000	50¢	-	40,000,000
5¢	-	450,000,000	\$1	-	40,000,000
10¢	-	160,000,000	Other Coins	-	120,000,000
25¢	-	80,000,000			
			Total	7	.670,000,000

### B. Proof Coins and Medals

35,000,000

### C. Foreign Coins

No identified capacity - will be handled on individual case basis consistent with available capacity and other production requirements.

### D. Melting and Casting

Produce ingots required for:

9 billion bronze l¢ coins.

1.5 billion cupro-nickel 5¢ coins.

Provide building space for 50% expansion.

### E. Strip Preparation

Produce strip required for:
9 billion bronze 1¢ coins.
1.5 billion cupro-nickel 5¢ coins.

No bonding mill - space for future addition, if required.

### F. Blank Preparation and Coining

Produce blanks and coins as per figures in A above - 7.67 billion total.

Floor space, utilities and services to provide for expansion to 9 billion 1¢ pieces and 1.5 billion 5¢ pieces - 10.94 billion total.

### G. Shift Basis

Two shifts per day, 5 days per week, 240 days per year, except melting and casting will be operated three shifts per day.

### NEW DENVER MINT PROPOSED CRITERIA

## IV. GENERAL PLANNING FACTORS

- A. Separate buildings, or separate areas for:
  - 1. Melting, casting, hot rolling and surface milling
  - 2. Strip finishing, blanking, coining, storage and shipment
- 3. Proof coining
  - 4. Administrative and support functions
- B. Production concept based on single story sequential flow with minimum vertical movement of production materials.
- C. Areas for rolling, blanking and coining will be isolated and provided with noise depressants.
- D. Facility must comply with Occupational Safety and Health Act of 1970.
- E. Facility must comply with local, state and federal laws and regulations regarding air and water pollution prevention and solid wastes disposal.
  - F. Facility will be planned for maximum reasonable expandability.
- G. Surge storage will be provided between various operations to allow for production interruptions.
- H. Parking will be provided for 450 employee automobiles and 260 visitor automobiles.

## NEW DENVER MINT APPROXIMATE BUILDING SPACE REQUIREMENTS

Function	Square Feet			
Strip Production Facility	194,000			
Coining Facility	228,000			
Proof Coining	18,000			
Administration and Production Support	180,000			
TOTAL	620,000			

### FUNDING OBLIGATION - BY FISCAL YEAR

### PLANNING SCHEDULE - NEW DENVER MINT

Cost Element	ì973	1974	1975	1976	1977	1978	FY 1979	Dolla in Milli
SITE Acquisition Development Work	1.50		0.80					1.5
ARCHITECT-ENGINEER Criteria Development Production Process Design Site Development Dwgs. Facility Bldg. Design Final Facility Besign Equipment Specs. and Survey Equipment Potential Equipment Procurement, Bid	0.06 0.30 0.12 1.44		0.20					0.00 0.31 0.11 1.44 0.20
Review, Installation Dwgs.  BUILDING (s) Construction Cost			1.25	21.60				21.6
EQUIPMENT  Equipment Cost  Equipment Installation Cost			14.25	3.50	0.25			18.0
CONSTRUCTION MANAGEMENT Construction Supervision Equipment Inst. Supervision			1.00		0.60	一类		1.0
START-UP AND RUN-IN						0.60		0.6
RELOCATION AND TRANSITION						127	0.28	0.2
FUNDING REQUIREMENTS	3.50		17.50	25.10	5.85	0.60	0.28	52.8

### NEW DENVER MINT HISTORY AND SEQUENCE OF ACTIVITIES

### I. AUTHORIZATION

Public Law 88-102, approved August 20, 1963 (31 U.S.C. 291-294), authorized the construction and equipping of buildings required in connection with the operations of the Bureau of the Mint. Authority for a mint at Denver is contained in 31 U.S.C. 261.

### II. APPROPRIATIONS

FY 1972 - \$1,500,000 for site acquisition FY 1973 - \$2,000,000 for architect-engineering services

### III. SEQUENCE OF ACTIVITIES

### A. Completed Actions

Prior to FY 1972 - Studies regarding coinage requirements, management study of new Denver Mint, Case Study of Philadelphia Mint, study concluding that Denver is optimum location for new mint.

During FY 1972 - Development of criteria for mint and for site, liaison with Denver and Colorado officials regarding site, site survey by GSA, preliminary site selection by Treasury, screening of architectengineer design firms, completion (in-house) of preliminary industrial process layouts including development of specific equipment criteria and design scope of services.

July 7, 1972 - Announcement by GSA of selected A-E firm.

August 4, 1972 - Draft Environmental Impact Statement issued.

September - December 1972 - Further consultations with Denver Mayor regarding site.

December 1972 - Denver City Council approves Mayor's program for site acquisition by the City.

January 1973 - GSA, Treasury and City working on formal agreement for site acquisition.

February 5, 1973 - Final Environmental Impact Statement issued.

### NEW DENVER MINT HISTORY AND SEQUENCE OF ACTIVITIES

### III. SEQUENCE OF ACTIVITIES (cont'd.)

### B. Future Actions

July 1, 1973 - A-E start design.

October 1974 - Procurement contracts for major process equipment.

January 1975 - Start site/building construction.

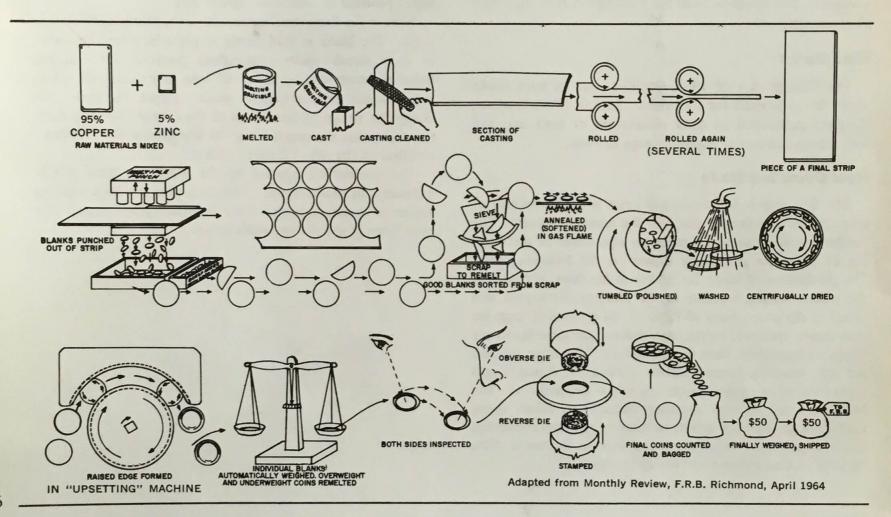
April 1976 - Start equipment installation.

January - April 1978 - Complete buildings/equipment installation.

April 1978 - July 1979 - Start-up, relocation and transition.

July 1, 1979 - New Denver Mint fully operational.

### MINTING CENTS



can be used interchangeably with them in coin-operated machines. The silverless coins are 9.3% lighter than their 90% silver counterparts.

### Mint Marks

The Coinage Act of 1965 specified that no mint marks would be authorized for five years. Late in 1967, however, Congress authorized an early resumption of their use, and they reappeared on our regular coinage in 1968.

### How Coins are Made

The first step in the minting of coins is the production of strips of the appropriate alloys of the proper thickness. The production of strips and subsequent operations in the minting of cents are graphically shown on the following page. The production of strips for nickels is the same, except that the metals melted together in the crucible are copper and nickel in the proportions of 75 to 25. In the case of strips for clad dimes, quarters, halves, and dollars, the three layers are produced separately, then fused together. The strips are then fed into blanking presses. These presses cut round blanks (planchets) of the approximate size of the finished coin. The blanks are run through annealing furnaces to soften them; next through tumbling barrels or rotating cylinders containing chemical solutions which clean and burnish the metal; then they are washed and put into drying machines.

The blanks then go to the milling or "upsetting" machines, which produce the raised or "upset" rim.

Next is the important operation of the stamping or coining press. The blank is held firmly in place by a ring, or collar, as it is struck under tremendous pressure; for example, one-cent pieces require about 40 tons of pressure, the larger coins require proportionately more. Upper and lower dies stamp the design on both sides of the coin at the same time. Grooves inside the ring holding the blank form the "reeding" or ridges on the rim of finished coin.

The productive capacity of the Mints has been greatly expanded in recent years. This fact, plus the large existing stocks of coins, indicates there is virtually no chance of a coin shortage in the foreseeable future.

OPTIONAL FORM NO. 10 MAY 1992 EDITION GSA FPMR (41 CFR) 101-11.5

### UNITED STATES GOVERNMENT

## Memorandum

TO: Dr. Alan J. Goldman

Assistant Director for Technology

FROM:

: James R. McGee

. grm

Chief, Security and Safety

SUBJECT: Criterion Review--New Denver Mint

Concerning section 3e of the Scope for the Design of the New Denver Mint (Design for a security system), consideration should be given to designing a security and fire protection system compatible to a computer system (such as a Systems 7). All interior/exterior alarms, circuitry, etc. could be controlled by the computer/console.

DATE: August 6, 1973

Provisions should be made for regular power, standby and emergency power; this power to provide for lights, alarms, electronic doors, etc.

Planning should also include electronic card access control into sensitive areas. This access should be compatible with the computer controlled system.

Naturally, as covered in the Planning Criteria Document, all equipment, material, supplies, etc. must comply with existing OSHA standards.

In planning for Vault construction, consideration should be given to installing telephones for emergency use in the Vaults.

I would also like to review the Architect-Engineer's designs for a security and fire system prior to implementation.

cc: Mr. F. H. MacDonald - Washington
" Frank Rhee Denver





### THE DEPARTMENT OF THE TREASURY

WASHINGTON, D.C. 20220

September 14, 1972

Mr. Nicholas G. Theodore Superintendent United States Mint Independence Mall Philadelphia, Pennsylvania 19106

Dear Mr. Theodore:

Accompanying this letter are several copies of the detailed criteria and proposed plant layout drawings for the new Denver Mint. This material has been prepared for presentation to the Architect/Engineering firm which will work on the project.

The team which has prepared this material would appreciate if the following members of your staff would review the material for the purpose of suggesting improvements: S. Rosenbaum, M. Henry, F. Breen, A. Leone, J. Keller, D. Rubolino.

In three or four weeks, Dr. Goldman will discuss the material at the Philadelphia Mint and suggestions will then be communicated to the Project Manager, Frank Rhea.

Thank you for your assistance.

Mary Brooks

Sincerely.

Director of the Mint

Enclosures



Rosenthe Square Intege Reduction 827A Roll mil Coolast Reservoir de Pany Equipment 5036 3600 High Britain Pailing Receivediting from With 7200 Angly & Promyring Engineers (Inducting Country) 50 × 80 3600 Machini Show ( Old Dinding) 120 + 30 3600 Supply Runa 9.00 Contractor Poilities Jern Olon onen's Sharer & Worsh", Showen 7 200 120 × 30 minelleren 120 20 widdlos - dend \_ 2700 i out I have the This Medica Cafethere Inthe 33833

are Calalatin Coming Building Bani 184900 215 184,900 25,800 office Meggmine 25800 Tourist my genin 8,600 219,300

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11. S. Mint Deuves 3.3 acres (143, 550 sq. ft.) Flot Lize = Sub- Brewnet 9840 A.ft. Busement. 46740 sq ft let Theory. 41780 sqft. Id Flow Megorana 14,710 eg f 2nd Flore / Cl 38385 09 / 3rd Floor 38010 pg ft. 189, 465 ng ft total (4.34 acres)

## LAYOUT NOTES

- ) Hat dransalere for small Ingots

  In Ginin, Blds
- 2) AVE Study Meterials Hendling
- 3) Extension behind Melting Area for Melting Electrics, Foremen Offices, May sis and Foilets/Showers Add 25 to entire Melting Building (Coining Building
  - 4) 5 ft more for Blank Annealing
  - 5) Proof Coins Bldng -50,000 Sq. Ft.
  - 6) Bell amealing Inoce Philadelphie = 3500 Sq. 7t.
  - 7) Vant Spaa in preust Denne 17 ms - 7560 mg for 5360 market

Jan Bungais

\25 /an 1972/ GAS SITUATION / MR HARDY Proble Service Company
48, un cu. ft. / hours Electric Rate Demand \$1.35 per KW - all over 500 KW Energy all order 500,000 KWH uned Charge \$ ,0063 per KWH Reduction on state in 2% of fill if we provide tronsformers Effective Touch in EY 1972 / No more interruptible constoners No customer in lacear of 3,000 cu. ft / hr. - Inie gelot plante et cool mines 210 Stage Fuel Oil Proposition Proposition Consider election, heating of estima Most - in ion the me may be more levomer The

GAS Present Use Interreptable 20 m cu ft / month - will be refused 9% per Total 25 m cu ft/ month Explore-Gas/Propone Situations
- Also Steam from Zuni Plant - FUEL OIL SITUATION

10/80

Correct Clad 104 strain 14

Produce strain for 14 prieses only
Start with Pig Prozen Steps Also new metal tecrap Melt and fright the Horizontal thim - no sealing -Cold Roll in me (or two miles) Control Sit for D. C. Semi- Continuous - Feely while friend · Freder D. Orelest- Idet roll to . 400 Cold roll is me ( thoo will!) To Prival gange The track consists for intermedial to Blank Unneal of clean 54 tags Clean only for 1+ upaet Con Court of Bay often of they

Dr. Alan J. Goldman, Asst. Director for Technology

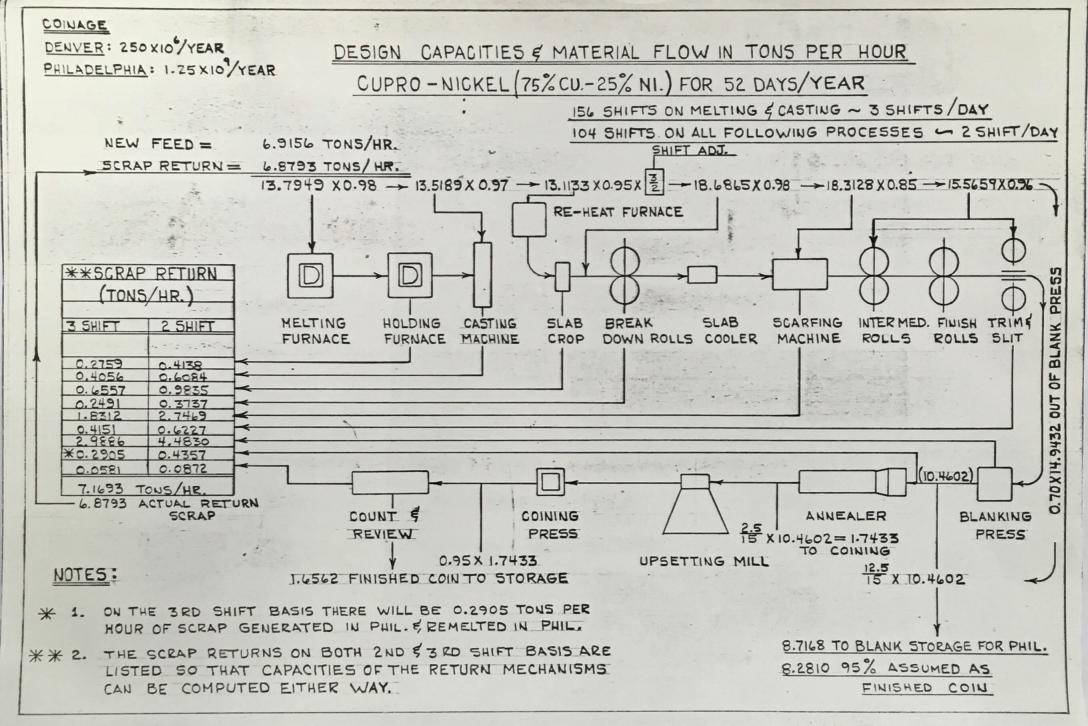
Frank W. Rhea, Facilities Project Manager

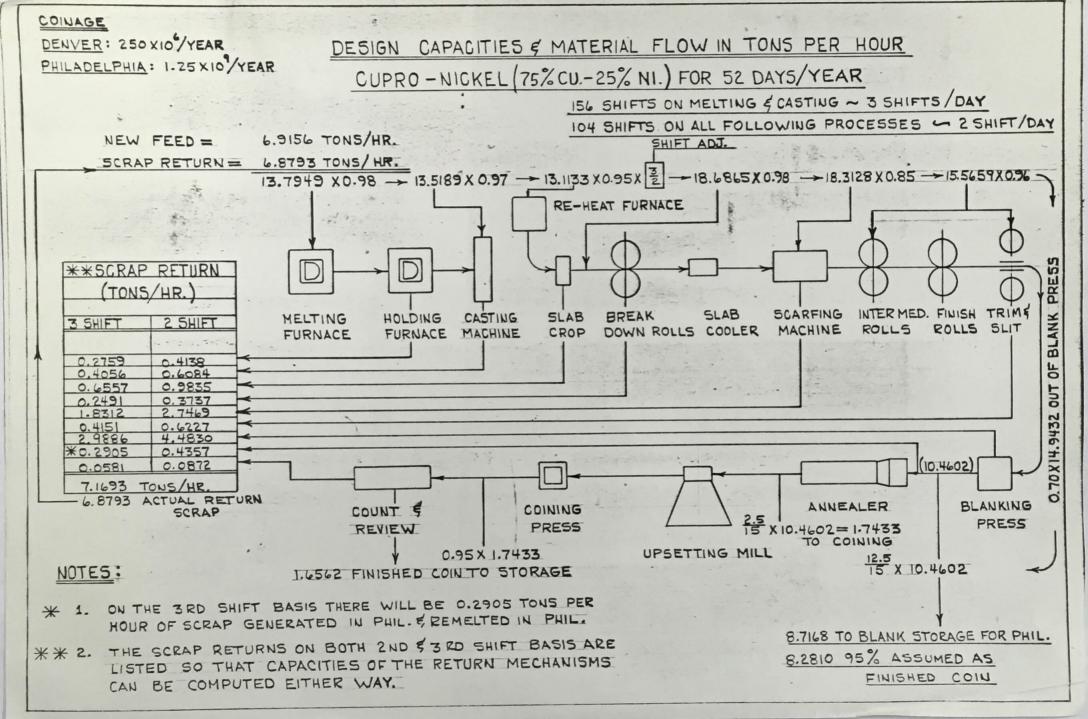
New Denver Mint

- 1. Attached are copies of the revised papers for the new Mint. As we discussed earlier, the differences are so minor that it is not worthwhile at this point to redo the drawings.
- 2. My proposed distribution (which I request you handle) of these sets is:
  - 2 Director's Office
  - 2 Dr. Goldman
  - 1 George Ambrose
  - 4 Philadelphia Mint (with drawings)
- 3. The nine sets are in two envelopes which you probably will not receive at the same time.

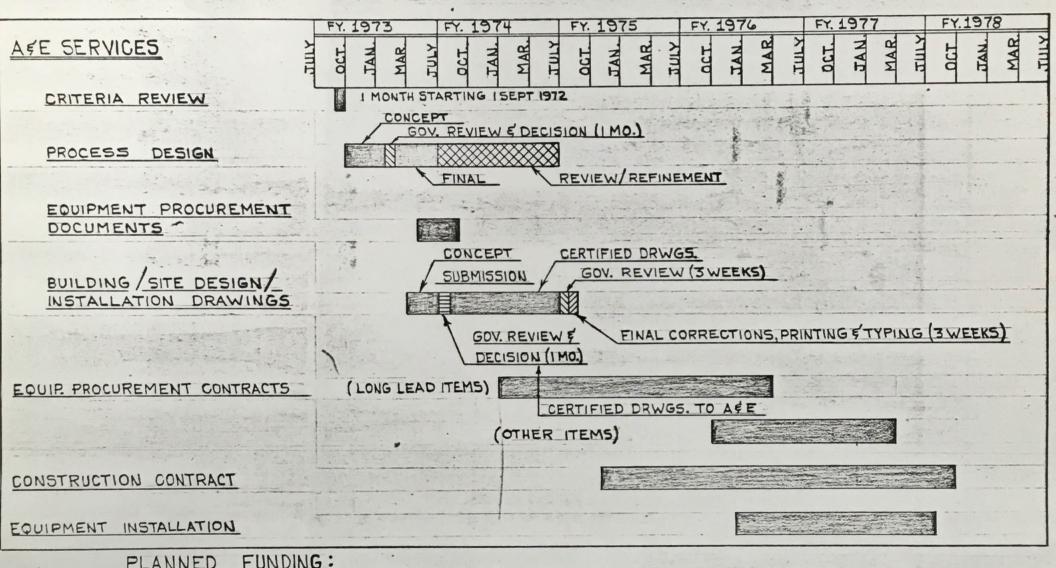
Enclosures

#### COINAGE DENVER: 250 XIO YEAR CAPACITIES & MATERIAL FLOW IN TONS PER HOUR PHILADELPHIA: 1-25 X10 YEAR CUPRO - NICKEL (75% CU.-25% NI.) FOR 52 DAYS/YEAR 156 SHIFTS ON MELTING & CASTING ~ 3 SHIFTS / DAY 104 SHIFTS ON ALL FOLLOWING PROCESSES - 2 SHIFT/DAY NEW FEED = 6.9156 TONS/HR. SHIFT ADJ. SCRAP RETURN = 6.8793 TONS/HR. 13.7949 X0.98 → 13.5189 X 0.97 → 13.1133 X0.95 X 2 -18.6865 X 0.98 -> 18.3128 X 0.85 -> 15.5659 X 0.96 RE-HEAT FURNACE \*\*SCRAP RETURN (TONS/HR.) 3 SHIFT 2 SHIFT MELTING HOLDING CASTING SLAB SCARFING INTERMED. FINISH TRIME BLANK FURNACE FURNACE MACHINE CROP DOWN ROLLS COOLER MACHINE ROLLS ROLLS 0.2759 0.4138 0.4056 0.6084 0.6557 0.9835 70 X14.9432 OUT OF 0.3737 1.8312 4.4830 \*D. 2905 0.4357 0.0581 0.0872 (10.4602) 7.1693 TONS/HP 6.8793 ACTUAL RETURN SCRAP COUNT \$ COINING ANNEALER BLANKING 2.5 X 10.4602 = 1.7433 REVIEW PRESS PRESS TO COINING 0.95 X 1.7433 UPSETTING MILL NOTES: 12.5 15 X 10.4602 1.6562 FINISHED COIN TO STORAGE ON THE 3RD SHIFT BASIS THERE WILL BE 0.2905 TONS PER HOUR OF SCRAP GENERATED IN PHIL. & REMELTED IN PHIL. THE SCRAP RETURNS ON BOTH 2ND \$ 3 RD SHIFT BASIS ARE 8.7168 TO BLANK STORAGE FOR PHIL. LISTED SO THAT CAPACITIES OF THE RETURN MECHANISMS 8.2810 95% ASSUMED AS CAN BE COMPUTED EITHER WAY. FINISHED COIN



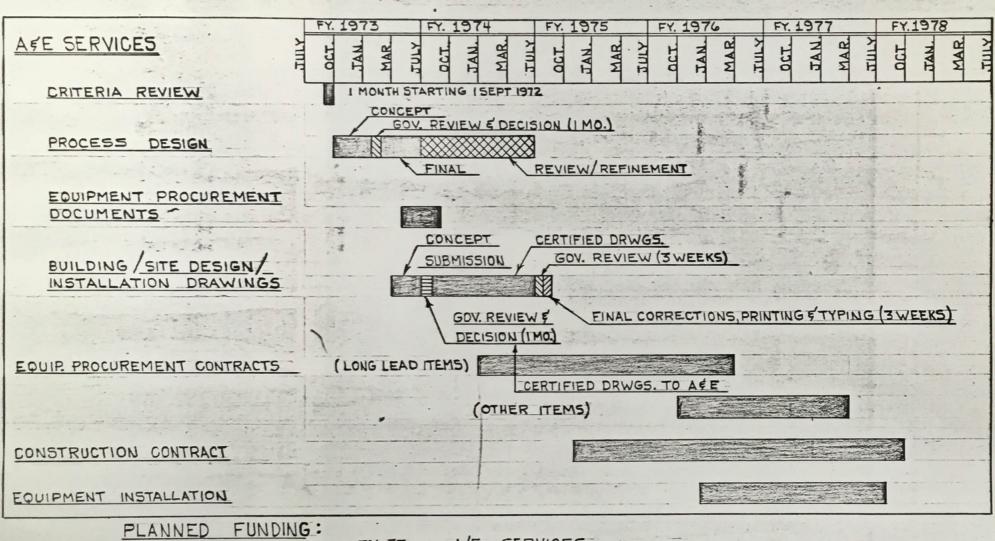


COINAGE DENVER: 250 X10 YEAR CAPACITIES & MATERIAL FLOW IN TONS PER HOUR DE5IGN PHILADELPHIA: 1.25 XIO YEAR CUPRO - NICKEL (75% CU.- 25% NI.) FOR 52 DAYS/YEAR 156 SHIFTS ON MELTING & CASTING ~ 3 SHIFTS / DAY 104 SHIFTS ON ALL FOLLOWING PROCESSES - 2 SHIFT/DAY 6.9156 TONS/HR. NEW FEED = SHIFT ADJ. SCRAP RETURN = 6.8793 TONS/HR. 13.7949 x0.98 → 13.5189 x 0.97 → 13.1133 x0.95 x 3 → 18.6865 x 0.98 → 18.3128 x 0.85 → 15.5659 x 0.96 -RE-HEAT FURNACE PRE55 \*\*SCRAP RETURN (TONS/HR.) SCARFING BREAK SLAB MELTING HOLDING CASTING SLAB BLANK 2 SHIFT 3 SHIFT SLIT DOWN ROLLS COOLER MACHINE ROLLS ROLLS FURNACE MACHINE CROP FURNACE 0.2759 0.4138 70 X14.9432 OUT OF 0.4056 0.6084 0.9835 0.6557 0.2491 0.3737 2.7469 1.8312 0.6227 4.4830 **\*0.2905** 0.4357 0.0872 0.0581 (10.4602) 7.1693 TONS/HR ACTUAL RETURN BLANKING COUNT \$ ANNEALER SCRAP COINING 2.5 X 10.4602 = 1.7433 PRESS PRESS REVIEW TO COINING UPSETTING MILL 0.95 X 1.7433 15 X 10.4602 NOTES: 1.6562 FINISHED COIN TO STORAGE ON THE 3RD SHIFT BASIS THERE WILL BE 0.2905 TONS PER HOUR OF SCRAP GENERATED IN PHIL. & REMELTED IN PHIL. 8.7168 TO BLANK STORAGE FOR PHIL. THE SCRAP RETURNS ON BOTH 2ND \$ 3 RD SHIFT BASIS ARE \* \* 2. 8.2810 95% ASSUMED AS LISTED SO THAT CAPACITIES OF THE RETURN MECHANISMS BE COMPUTED EITHER WAY. FINISHED COIN



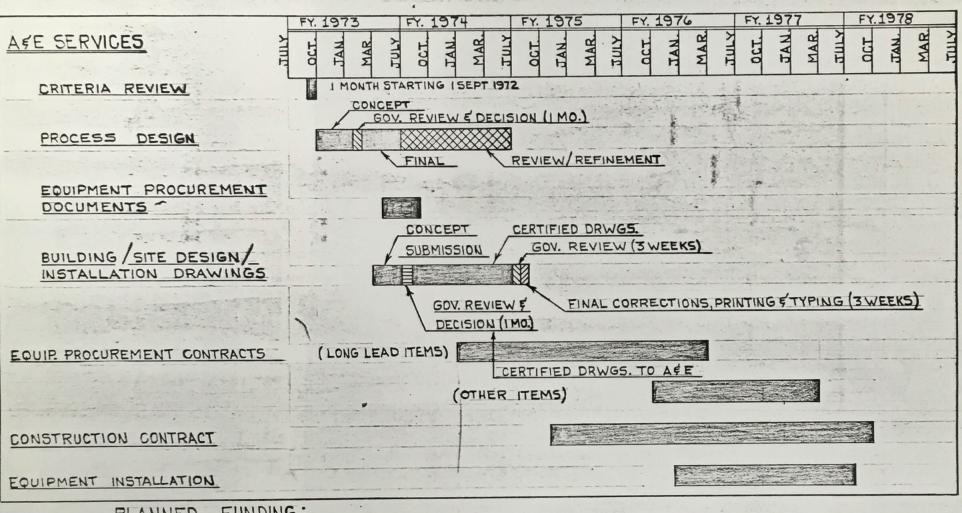
FUNDING: PLANNED

A/E SERVICES FY 73 EQUIP. PROCUREMENT, A/E SERVICES, CONSTRUCTION MANAGEMENT FY 74 CONSTRUCTION AND EQUIPMENT INSTALLATION EQUIPMENT PROCUREMENT START-UP, RE-LOCATION



A/E SERVICES FY 73 FY 74

EQUIP. PROCUREMENT, A/E SERVICES, CONSTRUCTION MANAGEMENT CONSTRUCTION AND EQUIPMENT INSTALLATION EQUIPMENT PROCUREMENT START-UP, RE-LOCATION



PLANNED FUNDING:

FY 73

A/E SERVICES

EQUIP. PROCUREMENT, A/E SERVICES, CONSTRUCTION MANAGEMENT

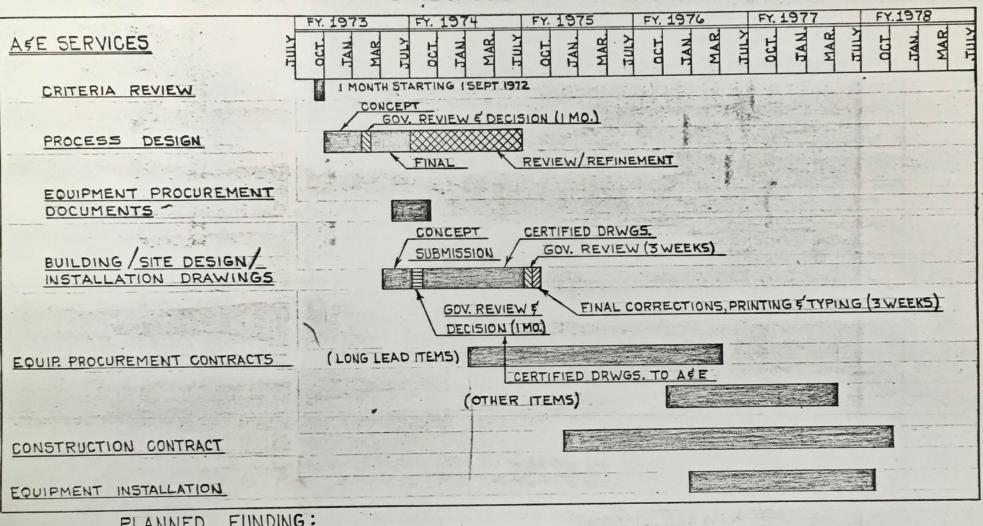
FY 75

CONSTRUCTION AND EQUIPMENT INSTALLATION

EQUIPMENT PROCUREMENT

FY 77

START-UP, RE-LOCATION



FUNDING: PLANNED

FY 73

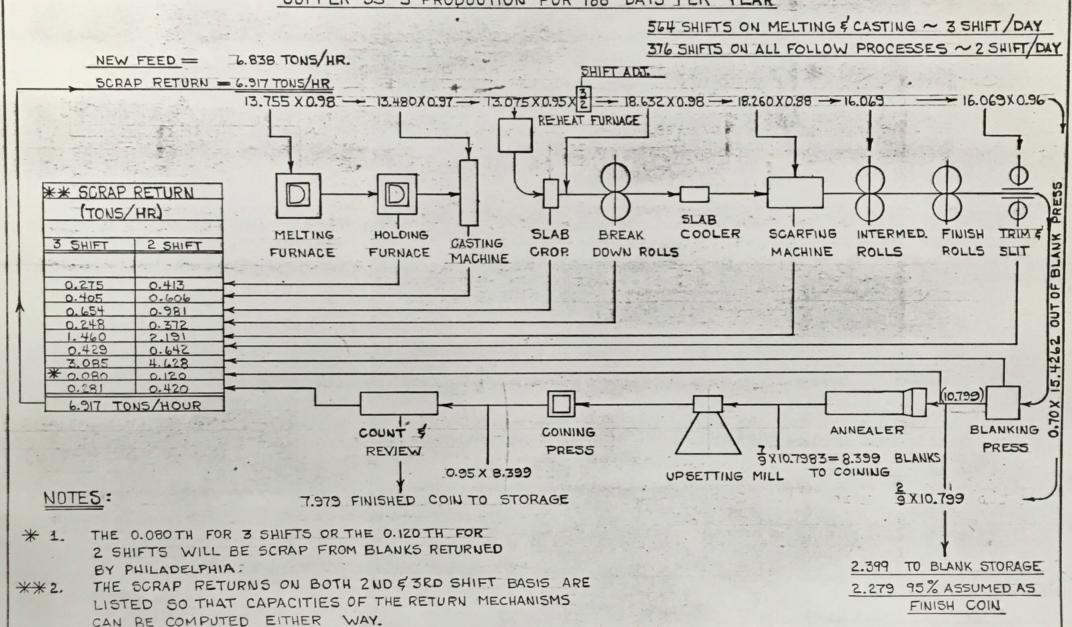
A/E SERVICES EQUIP PROCUREMENT, A/E SERVICES, CONSTRUCTION MANAGEMENT CONSTRUCTION AND EQUIPMENT INSTALLATION EQUIPMENT PROCUREMENT START-UP, RE-LOCATION

DENVER: TX10 YEAR

PHILADELPHIA: 2X10 YEAR

### DESIGN CAPACITIES & MATERIAL FLOW IN TONS PER HOUR

COPPER 95-5 PRODUCTION FOR 188 DAYS PER YEAR



COINAGE DENVER: 7X109/YEAR DESIGN CAPACITIES & MATERIAL FLOW IN TONS PER HOUR PHILADELPHIA: 2X10 YEAR COPPER 95-5 PRODUCTION FOR 188 DAYS PER YEAR 564 SHIFTS ON MELTING & CASTING ~ 3 SHIFT DAY 376 SHIFTS ON ALL FOLLOW PROCESSES ~ 2 SHIFT/DAY 6.838 TONS/HR. NEW FEED = SHIFT ADJ. SCRAP RETURN = 6.917 TONS/HR - 13.075 X 0.95 X 2 -- 18.632 X 0.98 -- 18.260 X 0.88 -- 16.069 - 16.069 X 0.96 13.755 X 0.98 -- 13.480 X 0.97 -REHEAT FURNACE \*\* SCRAP RETURN (TONS/HR) SLAB INTERMED. FINISH SCARFING SLAB BREAK COOLER HOLDING MELTING CASTING ROLLS SLIT 3 SHIFT 2 SHIFT MACHINE ROLLS CROP. DOWN ROLLS FURNACE FURNACE MACHINE 0.413 0.275 0.405 0.606 0.654 0.981 0.372 0.248 2.191 1.460 0.429 0.642 3.085 4.628 \* 0.080 0.120 0.420 (10.799) 6.917 TONS/HOUR BLANKING ANNEALER COUNT 5 COINING PRESS REVIEW PRESS \$X10.7983=8.399 BLANKS TO COINING 0.95 X 8.399 UPSETTING MILL \$ X10.799 NOTES: 7.979 FINISHED COIN TO STORAGE THE 0.080 TH FOR 3 SHIFTS OR THE 0.120 TH FOR \* 1. 2 SHIFTS WILL BE SCRAP FROM BLANKS RETURNED TO BLANK STORAGE BY PHILADELPHIA. THE SCRAP RETURNS ON BOTH 2ND & 3RD SHIFT BASIS ARE 2.279 95% ASSUMED AS \*\* 2. LISTED SO THAT CAPACITIES OF THE RETURN MECHANISMS FINISH COIN CAN BE COMPUTED EITHER WAY.

COINAGE DENVER: 7X109/ YEAR DESIGN CAPACITIES & MATERIAL FLOW IN TONS PER HOUR PHILADELPHIA: 2X10 YEAR COPPER 95-5 PRODUCTION FOR 188 DAYS PER YEAR 564 SHIFTS ON MELTING & CASTING ~ 3 SHIFT DAY 376 SHIFTS ON ALL FOLLOW PROCESSES ~ 2 SHIFT/DAY 6.838 TONS/HR. NEW FEED = SHIFT ADJ. SCRAP RETURN = 6.917 TONS/HR - 18.632 X 0.98 -- 18.260 X 0.88 -- 16.069 ---- 16.069 X 0.96 13.755 X 0.98 -RE-HEAT FURNACE \*\* SCRAP RETURN (TONS/HR) COOLER INTERMED. FINISH BREAK SCARFING SLAB MELTING HOLDING CASTING 3 SHIFT 2 SHIFT ROLLS MACHINE CROP. DOWN ROLLS ROLLS FURNACE FURNACE MACHINE 0.413 0.275 0.405 0.606 0.654 0.981 0.248 0.372 2.191 0.429 0.642 4.628 3.085 \* 0.080 0.120 0.420 0.281 (10.799 TONS/HOUR 6.917 ANNEALER COINING COUNT 5 PRESS REVIEW 9 X 10.7983 = 8.399 BLANKS TO COINING 0.95 X 8.399 UPSETTING MILL 5 X10.799 NOTES: 7.979 FINISHED COIN TO STORAGE THE 0.080 TH FOR 3 SHIFTS OR THE 0.120 TH FOR \* 1. 2 SHIFTS WILL BE SCRAP FROM BLANKS RETURNED TO BLANK STORAGE BY PHILADELPHIA. THE SCRAP RETURNS ON BOTH 2ND & 3RD SHIFT BASIS ARE 2.279 95% ASSUMED AS \*\* 2.

LISTED SO THAT CAPACITIES OF THE RETURN MECHANISMS

CAN BE COMPUTED EITHER WAY.

TRIM &

SLIT

BLANKING

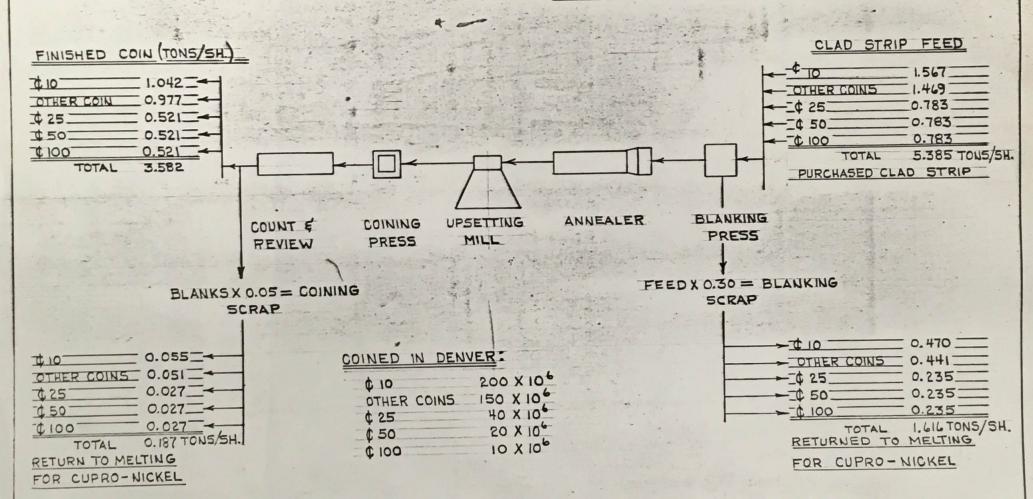
PRESS

FINISH COIN

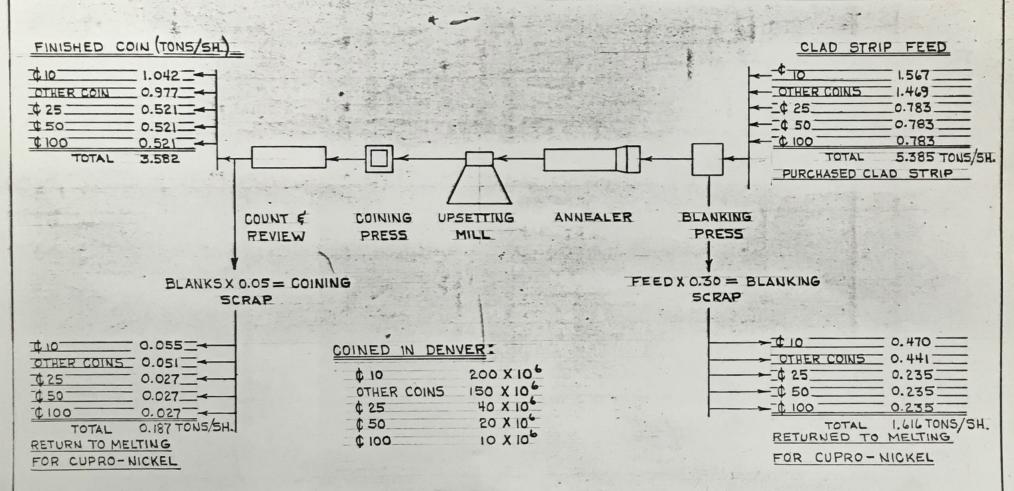
COINAGE DESIGN CAPACITIES & MATERIAL FLOW IN TONS PER HOUR DENVER: 7X103/YEAR PHILADELPHIA: 2X10 YEAR COPPER 95-5 PRODUCTION FOR 188 DAYS PER YEAR 564 SHIFTS ON MELTING & CASTING ~ 3 SHIFT DAY 376 SHIFTS ON ALL FOLLOW PROCESSES ~ 2 SHIFT/DAY 6.838 TONS/HR. NEW FEED = SHIFT ADJ. SCRAP RETURN = 6.917 TONS/HR - 13.075 X 0.95 X 2 - 18.632 X 0.98 - 18.260 X 0.88 - 16.069 - 16.069 X 0.96 RE-HEAT FURNAGE \*\* SCRAP RETURN (TONS/HR) INTERMED. FINISH COOLER SCARFING SLAB BREAK HOLDING MELTING CASTING ROLLS SLIT MACHINE ROLLS CROP. DOWN ROLLS 2 SHIFT 3 SHIFT FURNACE FURNACE MACHINE 0.413 0.275 0.606 0.405 0.654 0.981 0.248 0.372 1.460 2.191 0.429 0.642 4.628 3.085 0.120 \* 0.080 (10.799) 0.281 0.420 TONS/HOUR 6.917 BLANKING ANNEALER COUNT \$ COINING PRESS PRESS REVIEW 9 X 10.7983 = 8.399 BLANKS TO COINING 0.95 X 8.399 UPSETTING MILL \$ X10.799 7.979 FINISHED COIN TO STORAGE NOTES: THE 0.080 TH FOR 3 SHIFTS OR THE 0.120 TH FOR \* 1. 2 SHIFTS WILL BE SCRAP FROM BLANKS RETURNED TO BLANK STORAGE BY PHILADELPHIA: THE SCRAP RETURNS ON BOTH 2ND \$3RD SHIFT BASIS ARE 2.279 95% ASSUMED AS \*\* 2. LISTED SO THAT CAPACITIES OF THE RETURN MECHANISMS FINISH COIN CAN BE COMPUTED EITHER WAY.

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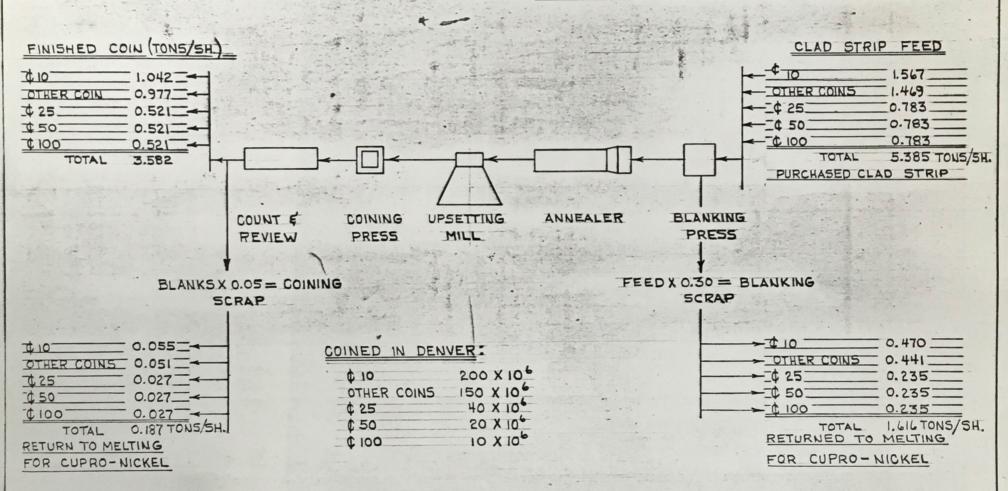
# CLAD COINAGE (91.66% CU-8.33% NI.), \$10,25,50,100 \$ OTHER COINS



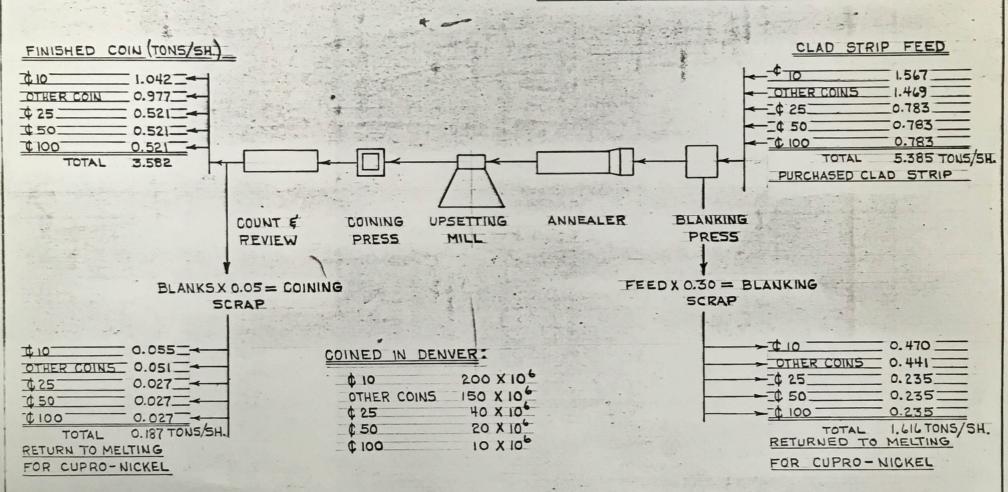
## DESIGN CAPACITIES & MATERIAL FLOW IN TONS PER SHIFT CLAD COINAGE (91.66% CU-8.33% NI.), \$10,25,50,100 \$0THER COINS



## DESIGN CAPACITIES & MATERIAL FLOW IN TONS PER SHIFT CLAD COINAGE (91.66% CU-8.33% NI.), \$10,25,50,100 \$0THER COINS



## CLAD COINAGE (91.66% CU-8.33% NI.), \$10,25,50,100 \$0THER COINS



1,012,000,000 per = 60,000 of 5,000,000,001 = 150,000 Af.

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Nebraska · Colorado ·

and Oklahoma .... Daily

Things to Do Today . . . . .

OPTIONAL FORM NO. 10 MAY 1962 EDITION GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

### Memorandum

Filp

TO: ASSOY-NEW MINT

DATE: 3/23/72

FROM: ( & D

SUBJECT: Vault Space

Recalculation Apace requirement at Dr - Goldman Request 3-17-72



TIONAL FORM NO. 10 MAY 1962 EDITION GSA FPMR (41 CFR) 101-11.6

### UNITED STATES GOVERNMENT RECEIVED

emorandum

TO H. Frost MAR 2 2 1972

DATE: March 17, 1972

A. J. Goldman FROM

OFFICE OF SUPERINTENDENT U. S. MINT AT DENVER

SUBJECT:

New Denver Mint Layout Drawings

The preliminary plant layout drawings prepared under your direction certainly reflect a great deal of thought and effort. Please convey my compliments to all whose efforts are reflected in the drawings.

I'd like the following comments to be considered:

- The scrap baler will require an area of at least 30 ft. x 50 ft. rather than the minimal area shown in the Strip Production Facility print. For ease of materials handling, I would recommend that it be placed adjacent to the melt make-up area. It will be used to compact scrap generated in slitting, blanking and coil milling-all of which will be delivered back to the make-up area.
- The coil milling (scarfing) machine will probably require an area approximately 50% longer than is indicated on the Strip Production Facility print. In addition, equipment for chip removal will necessitate increasing the width of the area considerably (50-75%). I would recommend that the coil milling operation be moved out from under the balcony and that an enclosed separate room be located under the balcony for the very noisy chip removal operation.
- The men's shower facility shown in the Strip Production Facility print ought to be adjacent to the melting and casting area, if possible, since these men will be using it most frequently.
- American Brass finds that having a roll grinding unit adjacent to the hot rolling area is very convenient since the largest and heaviest rolls are used on the hot mill. Transporting hot mill rolls to the machine shop building is not a very major inconvenience, but Duane Sjaardema should consider whether the work load justifies having one roll grinding unit in the hot mill area. If so, space must be provided.



- 5. I see no provision for a bag house (small separate building behind melting area) which will be useful for exhaust gas pollution control.
- 6. The analytical facilities should be located closer to the area which requires the most rapid service-the casting area.
- 7. The hot line spray box length should be increased by 50% to avoid having to slow down on the last pass to get adequate cooling. The latter is a problem at both Olin and American Brass. In addition, a shear should be located near the upcoiling end of the hot line.
  - 8. The coil storage area in front of the cold rolling mills is not very generous. If one of the three rolling mills or preheat furnace is down for repair, the coining area will be starved of material in less than one week. I would suggest that this storage area be tripled.
  - 9. If we buy a two stand tandem mill for intermediate cold breakdown, the room provided for cold mill electricals may be inadequate. We probably should consider approximately 5-7,000 square feet, especially if we use x-ray gaging to automatically control our mill screws and reel tensions. You probably noticed that at American Brass, the electricals to control their four stand tandem mill occupied an area five times that of the mill itself.
- 10. I notice no provision for penny line automation in the coining area. The line in Philadelphia has worked well and we should consider automating a fraction of the area from blank annealing through upsetting and coining. Perhaps, half the presses should not be automated in order to retain flexibility.
- 11. Space should be provided in the press area for several coin face inspectors such as you saw at AMF. Ideally, we should have one automatic inspection machine at each press at which major coinage (25¢, 50¢, \$1) is being struck. At the present time, the available inspection equipment does not operate at speeds which are compatible with coining speeds; however, this may change in the future. I would, therefore, suggest that area be provided around 15% of the presses for automated coin inspection equipment. Inspection equipment will probably occupy 1 1/2 2 times the area of the press it's serving.

- In your calculations of equipment capacity to match the required outputs listed in our production criteria, was an equipment downtime of approximately 25% used? This is Olin's average for normal and emergency maintenance work, time lost for breaks, lunch, shift changes, etc.
- 13. The coin press area, in general, could be increased by 20-30% to accommodate work benches for die setters, oil barrels, small enclosures for foremen's desks, etc.
- In the future, we will be using Federal Reserve 14. Board pallets to store coin bags. The pallets are 40" x 26" x 20" high (29" if retractable legs are down) and will hold 70 penny bags, 60 nickel bags, and 50 bags for the other denominations. An inventory of four to five billion pieces would be desirable, according to the Assistant Director for Production, if the required vault space can be provided. This is a major increase from the 45 day requirement stated in the original criteria.
- We should consider providing small lunch rooms 15. (such as you now have) in both the Strip and Coining buildings.

Many of the above comments argue for additional space. After you've had an opportunity to discuss this memo with your colleagues, a calculation of additional square footage would be in order.

In any case, feel free to disagree with any of the comments.

Mrs. B. Higby cc:

F.H. MacDonald

F.H. Rhea

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6
UNITED STATES GOVERNMENT

### Memorandum

TO : Denver Mint Personnel \*

DATE: March 14, 1972

FROM : H. Frost, Jr. 9499

SUBJECT: Design criteria for new Denver Mint

We have completed and turned into the Bureau a space survey. Doing this, we have, in a general way, collected a lot of data and placed it on drawings. It is now necessary for us to continue our efforts in more detail, in order to complete our presentation of design criteria as indicated in our memo of January 7 to the Bureau. Our first item should be formulation of data for the basic flow diagram.

In order to reemphasize the requirements of specific process data, listed here is a general breakdown of points required.

- 1. Brief description of machine or area of specific operation. Its function, feed setup, and discharge arrangements. Statement of new purchase or transfer from existing Denver Mint.
- 2. Capacity in pounds or tons per hour, or units per hour.
  - 3. Power requirements, including switch gear.
  - 4. Water and/or gas requirements.
- 5. Space requirements, both horizontal and vertical (close estimate), and the weight of equipment involved.
  - 6. Manufacturer's name and serial number if possible.
- 7. Storage or surge arrangements, or requirements used for both feed and discharge.
- 8. Equipment down time for maintenance, and necessary special tools and materials that must be on hand.



- 9. Recognition of any and all noxious problems and their solutions, i.e., noise, fumes, heat, dust, etc.
- 10. General statement of relationship to other units such as common utilities, safety hazards, necessary lighting, ventilation in other words, any information that may help and point toward better overall design.

We have taken the liberty of marking in red pencil on our space study drawings a numbered list of items that go into the basic flow diagram.

The following is the list and the number we are giving to a particular item. Each item will have to have its ten specific process data.

- 1. Storage area: virgin metal, primarily delivery and scrap storage.
  - 2. Make-up room including shears and scales.
  - 3. Melting furnaces.
  - 4. Holding furnaces.
    - 5. Casting machines.
  - 6. Elevators and cranes needed for the melting area.
    - 7. Salvage melting area.
    - 8. Furnace rebuilding area.
  - 9. Easy down and conveyor for handling cast slabs.
  - 10. Ingot cutoff saw.
  - 11. Ingot weight scale.
  - 12. Ingot storage area including gantry slab stacker.
  - 13. Reheat furnace and conveyor transfer system.
  - 14. Ingot roll conveyor.
  - 15. Breakdown roll.
  - 16. 80 ft. spray cooler.

- 17. Ingot trimming shear.
- 18. Primary roll upcoiler.
- 19. Torrington scarfing mill including uncoiler and upcoiler.
  - 20. Coil storage area including scales and scrap paper.
  - 21. Overheat crane system for hot rolling area.
- 22. Intermediate rolling mill including uncoilers and upcoilers.
- 23. Finished rolling mill including uncoilers and upcoilers.
  - 24. Slitting mill including uncoilers and upcoilers.
  - 25. Coil storage.
  - 26. 14 blanking presses.
  - 27. Blank storage area.
  - 28. 8 drum and annealers.
  - 29. Blank storage area.
  - 30. 12 upset mills.
  - 31. Upset blank storage area.
  - 32. 110 coining presses.
  - 33. 6 inspection tables.
- 34. 20 count and bag machines including coin weighing scales.
  - 35. Count and review storage area.
  - 36. Storage vaults including elevators.
  - 37. Loading dock and process area.
  - 38. Cranes and handling equipment for coining area.

In describing the various numbered areas and machines, the ten-point outline will serve as a guide.

Mrs. Grapin is available for any stenographic help needed.

#### HF: edg

cc: Dr. Alan J. Goldman
Superintendent
Deputy Superintendent
Project Engineer's Files

\* W. Darlington

R. Folsom

J. Johnson

R. Lord

F. Miller

H. Neal

H. Riddick

D. Sjaardema

A. Vaitaitis



#### THE DEPARTMENT OF THE TREASURY

WASHINGTON, D.C. 20220

December 30, 1971

AIR MAIL

Dr. Hildreth Frost Assayer United States Mint Colfax and Delaware Streets Denver, Colorado 80204

Dear Dr. Frost:

Recent discussions which I have had with colleagues in the metals industry have made me cognizant of serious attempts by state and local governments to improve safety and environmental standards in the metals industry. On the plant visits which will be made by the New Denver Mint project team, I would suggest that an attempt be made to obtain up=to-date information on scrubber systems in the melting and casting areas, noise control considerations in plant and equipment design, etc., so that the New Denver Mint is planned with these considerations in mind.

I have made a contact at Revere Copper and Brass. They semi-continuously cast a 41 inch wide ingot which is probably the widest in the copper industry. I shall try to arrange a visit to their plant in Rome, New York during January and will be in touch with you on the details of the visit.

Sincerely,

Alan J. Goldman

Asst. Director for Technology

cc: Betty Higby Charles Miller





#### THE DEPARTMENT OF THE TREASURY

WASHINGTON, D.C. 20220

December 14, 1971

Mrs. Betty Higby
Superintendent
United States Mint
Colfax and Delaware Streets
Denver, Colorado 80204

Dear Mrs. Higby:

On his visit with you during the week of November 8, the Deputy Director briefly discussed our New Denver Mint - Organization Plan for Criteria Development. Mr. MacDonald further indicated our need to proceed immediately on the development of preliminary criteria.

We are now implementing the Organization Plan for Criteria Development and Plan to proceed immediately on the task at hand. In consonance with this action, the assignment of personnel to major areas of responsibility is made as follows:

- Until such time as a Project Manager is assigned to the New Denver Mint project, Dr. H. Frost, Jr. is designated Technical Coordinator (Project Engineer). This action is in accordance with our previous discussion and your desire. He will report to this office through the Assistant Director for Technology, Alan J. Goldman.
- Denver Mint Division Managers and Engineering Coordinators as delegated to specific areas of responsibility on the organization plan are assumed acceptable to you. It is not our intent to build inflexibility into the plan, however we feel strongly that both the Division Manager and the Engineering Coordinator who will follow the project to completion in the specific area of responsibility must be designated now and become involved at the onset of the project. Please advise this office by December 1 should you care to suggest alternate personnel in the Engineering Coordinator category.
- Philadelphia Mint personnel designated on the Organization Plan are principally Division Managers and are established as primary contacts for discussion meetings to be held in that field office.



By a copy of this letter the Superintendent of the Philadelphia Mint and the Officer in Charge of the San Francisco Assay Office are advised of our short-range plans for the New Denver Mint. Further contacts will be made with Mr. Nicholas G. Theodore and may be made with Mr. John F. Brekle by Dr. Goldman and Dr. Frost for assistance in planning on the new facility. Your usual cooperation is solicited.

Sincerely,

Mary Brooks Director of the Mint

Enclosures 1

#### ORGANIZATION PLAN - FOR CRITERIA DEVELOPMENT

The attached organization chart shows the brookdown of major areas of responsibility and personnel to be responsible for Criteria Development on this project. Transition into design lisison, review, and approval and then into the construction phase and equipment theck-out is indicated.

In the criteria development place, the Division Managers in Denver have primary responsibility for the criteria, but meetings and discussions with Philadelphia Mint personnel as indicated will be held. An engineering coordinator is assigned to one or more major areas and will work with the division manager in the final formulation of criteria. The engineering coordinators report to the technical coordinator, and development of final criteria by the Architect-Engineer will be under the surveillance of this group.

Upon transition to the design liaison and review-approval phase, about July 1972, the engineer coordinators will be assigned full time to the project, will have primary responsibility in his assigned area, but will secure approval from appropriate division manager on significant decisions.

The same engineering group will move into the construction, equipment installation, and run-in phase and have principal responsibility in successful conclusion of the project.

Enclosure (1)

